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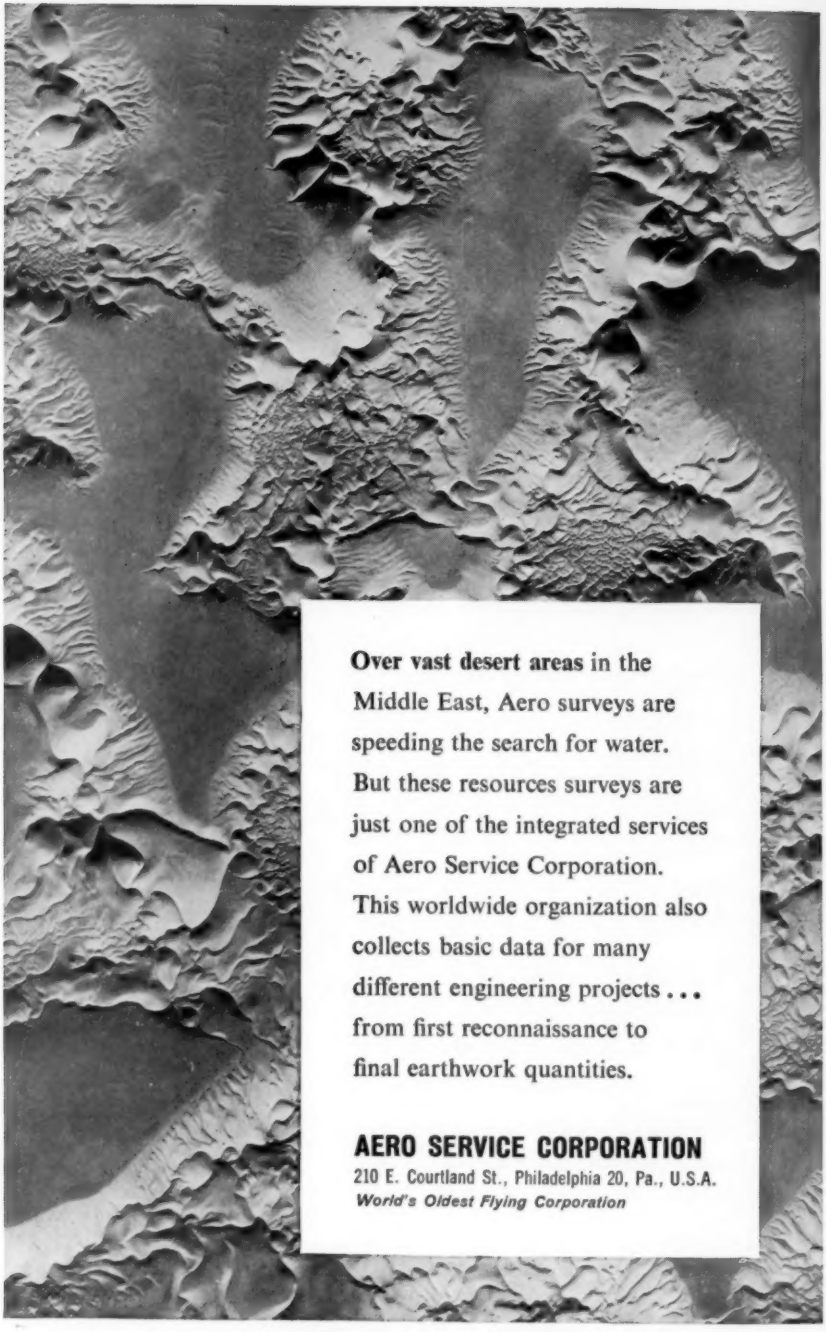
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Editor-in-Chief

Howard S. Rappleye

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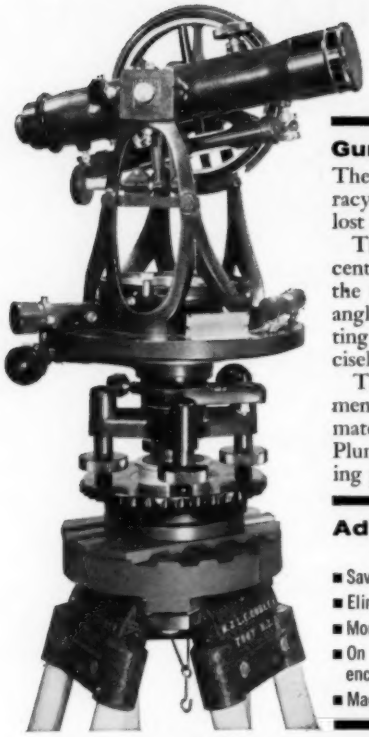

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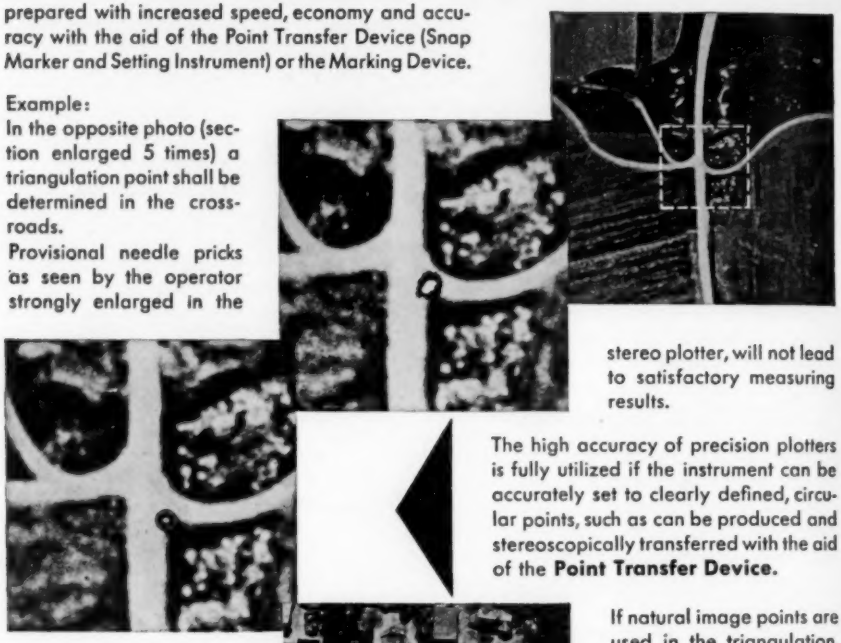

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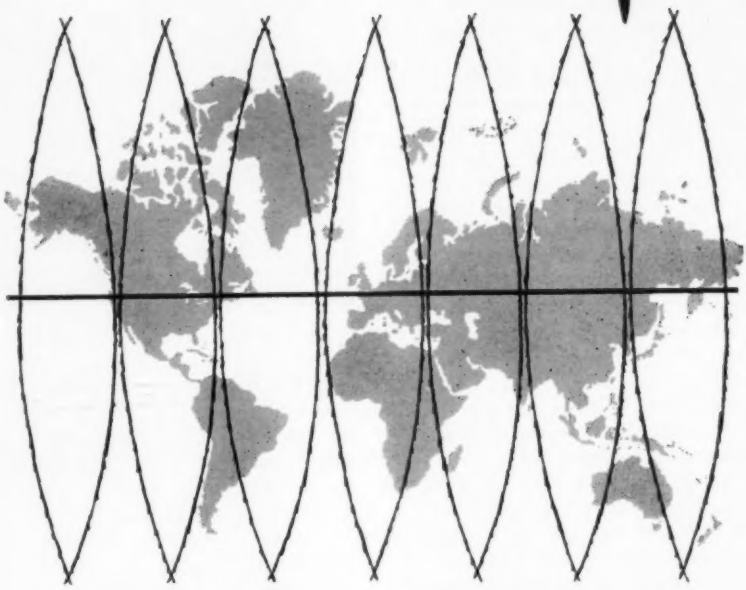

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Introducing Our New President

Brother B. Austin Barry, F.S.C., Associate Professor of Civil Engineering at Manhattan College, Riverdale, N. Y., is the new President of the American Congress on Surveying and Mapping for 1961.

A recognized authority on surveying and mapping, Brother Austin has long been active in efforts to reestablish the importance of the surveying-mapping complex in engineering generally. For the past five years, he has headed a task committee of the American Society of Civil Engineers on the status of surveying and mapping in the United States.

Brother Austin has been a member of the ACSM for the past fifteen years. He was a member of the Executive Committee of the Education Division for four years, and served one year as the chairman of that Division. He has served a two-year term as a member of the Board of Direction and was vice president of the Congress in 1960.

A registered professional engineer in New Jersey, Brother Austin is a former president of the Metropolitan New York Section of the American Society of Photogrammetry and serves on the board of directors for the North Atlantic Region. He is a member of the American Society for Engineering Education, the American Society of Civil Engineers, the Society of American Military Engineers, Sigma Xi, and Chi Epsilon, the national civil engineering honor fraternity.

He has written many articles and papers on the subject of surveying and mapping and is the co-author of "Noteforms for Surveying Measurements," published in 1957 by International Textbook Company of Scranton, Pa.

Brother Austin has been a member of the faculty of Manhattan College since 1943. He holds a bachelor of arts degree from Catholic University of America, a bachelor of civil engineering degree from Rensselaer Polytechnic Institute, and a master of civil engineering degree from New York University. He has been a member of the Brothers of Christian Education, the religious teaching order which conducts Manhattan College, since 1933.

BROTHER B. AUSTIN BARRY

A native of Newburgh, N. Y., Brother Austin is the son of Michael F. Barry of 56 Blooming Grove Turnpike. His sisters are Mrs. Edward A. Lahey of New Windsor and Mrs. Edward Wiest of Middle Hope. His family name is James T. Barry, and he attended St. Patrick's School in Newburgh and the Newburgh Free Academy.

The Twenty-first Annual Meeting

MORE THAN 2400 persons registered for the ASP-ACSM convention at the Shoreham Hotel in Washington, D. C., March 19–25, 1961, and approximately 6000 persons viewed the exhibits set up in conjunction with the convention.

The ACSM sessions were held during the latter half of the week. Rear Admiral H. Arnold Karo, President of the ACSM and Director of the Coast and Geodetic Survey, made the opening address at the initial plenary session. This was followed throughout the remainder of the week by numerous sessions and meetings of the technical divisions. Details of these activities will be reported under the individual division headings.

Abstract of President's Address

The American Congress on Surveying and Mapping is the only organization of its kind that effectively coordinates the work of the government surveyor and cartographer with that of state and private surveyors, cartographers, and engineers. One of its goals is the attainment of full professional recognition of the art of surveying and mapping, toward which end it has already made appreciable progress. Caution should be exercised, however, that training in this field contain some of the humanistic studies, so that the professional man will be a well-rounded individual.

Another goal of the ACSM is the spreading of good will and understanding among contemporaries in other lands. The well-rounded professional man will recognize this as an obligation for the promotion of international good will as well as the exchange of ideas. Through ACSM participation in FIG (International Federation of Surveyors) and other such organizations, this goal has been admirably advanced. It is incumbent upon all in this line of endeavor to do all they can to increase the standing of the field and to incur better international relationships.

Cartography Division

EDITOR'S NOTE.—The only copy furnished by the Cartography Division for inclusion in this report on the 21st Annual Meeting was the "Annual Report of the ACSM Cartography Division." Because this report only touched on the Annual Meeting in one short paragraph and because some of the material in the report has already been published in the "Congress News" department of SURVEYING AND MAPPING during the past year, the following has been put together from the printed program and constitutes a mere recital of the part played by the Division and its speakers during the Annual Meeting of last March.

During the forenoon of March 23, 1961, the Cartography Division held a Division meeting, with Division Program Chairman John W. Masterson presiding. The speakers, their professional affiliations, and the subjects of their talks are listed below:

Arthur F. Johnson, Chief, Field Investigations Branch, Bureau of Reclamation, U. S. Department of the Interior—"Surveys for Reclamation Planning."

Stewart H. Weene, Cartographer, U. S. Navy Hydrographic Office—"Fluorescent Charts—An Aid to Navigation."

Robert C. Klove, Assistant Chief, Geography Division, U. S. Bureau of the Census—"The Development of Base Maps of Urbanized Areas for the 1960 Census."

Kenneth L. Pyle, Senior Cartographer, Montgomery County (Pennsylvania) Planning Commission—"Problems in Urban Area County Mapping."

The first part of the plenary session Thursday afternoon was the responsibility of the Cartography Division, and, with Chairman Robert J. Beaton presiding, the following papers were presented:

Murray Y. Poling, Chief, International Technical Cooperation Staff, Coast and Geodetic Survey—"New Concept of International Technical Cooperation."

Carleton P. Barnes, Research Coordinator, Agricultural Research Service, U. S.

Department of Agriculture—"National Atlas of the United States."

Colonel Robert E. Herndon, Jr., Commander, USAF Aeronautical Chart and Information Center—"Modern USAF Cartography."

The Division held another meeting during the forenoon of Friday, March 24, 1961, and, with Division Program Chairman John W. Masterson presiding, the following papers were presented:

Arthur E. Molloy, Engineer, Bathymetric Section, U. S. Navy Hydrographic Office—"Exploratory Bathymetric Surveys in the Arctic Ocean."

Gordon E. Stine, Chief, Cartography Division, ACIC, and Otto C. Stoessel, Chief, Printing Division, ACIC—"Quality Control in USAF Chart Production and Printing."

Frederick K. Hayes, Assistant Chief, Mapping Branch, Department of Cartographyraphy, Army Map Service—"Utilization of the Klimsch Camera Variomat in Map Compilation."

Control Surveys Division

The first part of the plenary session during the afternoon of March 22 was under the sponsorship of the Control Surveys Division. Chairman Daniel E. Whelan presided, and the speaker, Rear Admiral Charles Pierce, U. S. Coast and Geodetic Survey, discussed "Concepts in Coordinate Surveying."

The paper dealt with the relative merits and the requirements of coordinate systems, including those used in the modern space age. For most engineering surveys, a simple system of rectangular coordinates, uncorrected for the curvature of the earth, is used. With the advent of the intercontinental ballistic missile, testing ranges of high-order accuracy become a critical military requirement for space coordinate systems. At the Rome Air Development Center the accuracy between all points was one foot or better in all three (x, y, and z) coordinates and one-half foot or better between ground stations. Translated, the proportional accuracy approaches 1:200,000.

To encourage more use of geodetic control by the engineering profession, the Coast and Geodetic Survey devised a simple State Plane Coordinate System for each of the States. Today these are used extensively in large engineering projects such as TVA, the Interstate Highway Program, Feather River and Delta Water Diversion Projects in California, etc.

Secretary of Commerce Hodges, a former Governor of North Carolina, set up a commission for the study of a uniform map law in that State, using the C&GS plane coordinate system as the official survey base. It is the hope that all the States will follow the example of North Carolina.

The paper also discussed satellite geodesy on an earth-centered, rectangular, space-coordinate system and a universal coordinate system based on the center of the sun. Finally, the paper strongly advocated a much greater use of the State Coordinate Systems which are an ideal compromise between local systems and the geographic system of latitudes and longitudes.

The business meeting of the Control Surveys Division was held at 10:00 a.m., Friday, March 24, 1961, with Chairman Daniel E. Whelan presiding.

Emory T. Snyder, Army Map Service, Chairman of the Membership Committee, gave no report, but it was pointed out by Chairman Whelan that there had been a healthy growth in membership.

James Buckmaster, U. S. Geological Survey, Chairman of the Research and Development Committee, began his report by commenting on the increased need for higher accuracies in control surveys. He spoke of the strides being made in the use of electronic instruments, especially in distance-measuring instruments and in computers, and the development of better accessory equipment allowing greater use of trilateration, and impressive electronic equipment for control of aerial photography. He mentioned that three transistorized, tape-recording, elevation meters will soon be in operation for fourth-order leveling. He pointed out the advantages secured in tubular-design, rigid-joint, aluminum tow-

ers, and concluded by remarking that, in spite of greater use of new high-speed and high-accuracy equipment, there remained a firm need for about every kind of control instrument and control party known.

Charles A. Whitten, Coast and Geodestic Survey, Chairman of the Technical Standards Committee, reported on action taken by the International Association of Geodesy in Helsinki last summer at its 12th General Assembly. A special committee of that Association recommended that countries attempt to secure internal accuracies in their horizontal control networks of one part in one hundred thousand and recommended specifications for base-line work, electronic distance measuring, spacing of bases, and number of nights of observations considered adequate for attaining such accuracy.

Professor Arthur J. McNair, Head, Surveying Department, School of Civil Engineering, Cornell University, reported as Chairman of the Public Education Committee. He pointed out that curricula at engineering colleges are being severely scrutinized with increasing tendencies to replace practical work in surveying and engineering with purely scientific and theoretical courses, and that unless the industrial users and surveying practitioners succeed much better than in the past in getting through to the educational administrators the training demands of the surveying profession, the surveying area is apt to suffer even more in the future. He suggested continuing effort on the part of all surveyors to alert students to the opportunities in the profession and to the real challenge in surveying.

Professor McNair then donned his other "hat" and, reporting as Chairman of the Nominating Committee, stated that the committee was proud and happy to nominate Professor Kenneth S. Curtis of Purdue University as incoming Director. After a call for other nominations from the floor, Professor Curtis was elected unanimously.

The Directors for 1961 are as follows:

Julius Speert, U. S. Geological Survey, Washington, D. C., who automatically becomes Chairman of the Division for 1961,

Max O. Laird, Western Electric Company, New York, N. Y., and

Kenneth S. Curtis, Purdue University, Lafayette, Indiana.

Immediately following the election, formal papers were presented, as listed below.

William Durbin, Geodesist, Aeronautical Chart and Information Center, presented a paper entitled "Investigation of the Determination of Gravity Anomalies from Geologic Structures and Formations." In this investigation the relationship of mass and attraction has been applied to the connection that exists between gravity and geologic formations. Each structure, apparently has a predictable gravity anomaly pattern. Many geologic features have been shown to possess distinct anomaly characteristics which can be categorized. Equations have been adapted from basic formulae to permit the determination of the maximum anomaly for any given structure. Numerous tests have been performed to verify these findings.

The computations and the methods employed in determining the various anomalies from geologic data were described. Conclusions that can be inferred from these findings were presented. It will be possible by this method to fill in the gravimetrically unknown areas where geologic information is available with anomalies of a predictable accuracy.

Charles H. Frey, Chief, Geo-Sciences Branch, Aeronautical Chart and Information Center, spoke concerning the "USAF Applications of Gravity Data."

On the basis of anticipated requirements, the USAF contracted with The Ohio State University for the collection and reduction of gravity information in March 1952. This and later contracts resulted in an extensive collection of gravity and related materials which became the foundation of the USAF Gravity Library. The Ohio State University collected information from commercial, educational, and foreign mapping sources and computed mean free-air anomalies for $5° \times 5°$ and $1° \times 1°$ squares where coverage permitted. Illustrations exhibited included; holdings categorized by the number of observations per degree square, areas of completed $1° \times 1°$ anomalies, and geophysical properties chart coverage.

Several significant uses of gravity information were discussed, including the establishment of the USAF WGS and its subsequent modification, and similar uses of gravity data to establish other datums. Current projects concerning the extrapolation of gravity to points above the earth's surface and the effect of gravity on missile guidance were discussed in some detail, along with the application of gravity to electronic distance measurement.

Robert Heape, Civil Engineer, U. S. Army Engineers, GIMRADA, discussed "Miniature Electronic Ranging Equipment."

The paper dealt with the description, development, and engineer tests of the Electrotape Model DM-20. This electronic, distance-measuring equipment is an outgrowth of that originally developed by Tellurometer, Ltd. GIMRADA has improved this type of equipment in both accuracy and portability, with the cooperation of its contractor, the Cubic Corporation, and it is a transistorized version of the "Micro-Dist."

The instrument is a single-package unit $13'' \times 10\frac{1}{2}''$ by 15" and weighs 25 pounds without the internal battery; with internal battery, an extra 39 pounds.

Accuracy tests were performed over distances ranging from 100 meters to 45 kilometers, with resulting mean accuracies varying from 1:9,000 to 1:340,000 resepctively. Attempts were made to measure a line 70 kilometers in length. The fine readings yielded accuracies comparable to those obtained on lines 20 and 40 kilometers in length. The tests were conducted in the Northern Virginia Area where well-vegetated, rolling terrain is generally well suited to the use of electronic ranging equipment.

The Control Surveys Division was responsible for the first part of the program for the planetary session of the Congress on Friday afternoon, March 24th.

"Space Geodesy for Missile Tracking," by Commander Glenn W. Moore, U. S. Coast and Geodetic Survey, described the requirements, and the methods by which they were met, for a remarkably accurate triangulation-Geodimeter survey in the area around Cape Canaveral, Florida. Highlighted were many of the trials and tribulations encountered by the field party, under the author's charge, in not only meeting the extremely rigid specifications but exceeding them by a wide margin.

Commander Moore's talk was supplemented by running commentary on an RCA motion picture by Lieutenant Commander Baker. The subject covered was the instrumentation used in the Asuza System, with particular emphasis on the measurement techniques involved in drift determinations.

"Speeding Up Surveys for Military Use," by Melvin C. Shetler, Chief, Surveying and Geodesy Branch, U. S. Army Engineers, GIMRADA, described in general some concepts of military survey operations and the types of equipment currently under develop-develop at GIMRADA. In addition he indicated developments contemplated during the next two to five years. The paper described the Long Range Survey System, Light Weight, which permits the rapid extension of ground control for mapping. Mr. Shetler also discussed other present and future equipment and techniques, with emphasis on compactness, as follows:

The Automatic Position Survey Equipment,

Smaller Gyro Azimuth Theodolites,

Smaller daylight Geodimeters,

Small electromagnetic wave instruments that will provide both distance and angular values,

Smaller Inertial Survey Equipment that will provide direct readout of position, azimuth, and elevation, and

Small Electronic Computers capable of handling all of the army's field survey problems.

Education Division

The last part of the plenary session of the Congress during the afternoon of Wednesday, March 22, 1961, was the responsibility of the Education Division. Professor Milton O. Schmidt, Department of Civil Engineering, University of Illinois, presented a paper entitled "Some Observations

on Four Year Professional Surveying Curricula in Western Europe."

Professor Schmidt reported on his educational experiences abroad during the 1959–60 school year when he studied Geodetic Engineering and Geodesy at the Swiss Federal Institute of Technology in Zurich, Switzerland, while a Fellow of the National Science Foundation. Observations were made of the four-year instructional programs in surveying in Switzerland and West Germany, and the detailed content of a typical curriculum at a West German engineering school was presented and analyzed. The speaker concluded with a clinical assessment of the grave impasse in professional surveying education in the United States and recommended, as a partial solution, the inauguration of a substantial fellowship program for study in West Germany.

The business meeting of the Education Division was called to order by the retiring chairman, Professor E. C. Wagner, University of Wisconsin, and was then turned over to the incoming chairman, Professor J. O. Eichler, Georgia Institute of Technology. The meeting was held during the forenoon of March 23, 1961. In accordance with the by-laws, no new member was appointed to the Board of Directors. The number on the board remains at three instead of four as heretofore.

The first order of business was consideration of the continuation of the Moffitt pilot study for the State of California which discloses the needs for surveyors, geodesists, and photogrammetrists by industry in that State. The results have been so gratifying for the State of California that last year the Commission felt that this study should be made on a national basis. Professor R. D. Turpin, University of Wisconsin, volunteered to take the chairmanship of what he calls the "Survey and Needs Commission," which will make this important and timely study based on an anticipated 2,000 questionnaires. These will be sent to people representing appropriate industries making use of surveying, geodesy, and photogrammetry. A $2,000 budget is being asked for to provide for this project.

Professor Paul P. Rice, Rutgers University, made a plea for the support of the Education Division in connection with the evening courses given by Rutgers University in Fundamentals of Surveying, Photogrammetry and Air Photo Interpretation, by authorizing the printing of the words "In Cooperation with the American Congress on Surveying and Mapping, Education Division, Property Surveys Division" at the bottom of the brochure regarding these evening courses. A motion was made a seconded to this effect. After much discussion the motion was defeated. A substitute motion by Professor John G. McEntyre, Kansas State University, was passed. The substitute motion was "that the Executive Committee investigate the feasibility of endorsing the extension and continuation courses in surveying sponsored by the various groups; such as the University of Kansas."

There followed a discussion of a proposal to make a sound motion picture of about 25 minutes to tell the story of Surveying, Photogrammetry, and Geodesy, with emphasis on the level of the production and means of producing it. After some discussion, Professor S. B. Irish, Princeton University, moved that the Executive Committee of the Education Division appoint a committee to look into the problem of producing a film to publicize surveying and mapping. The motion was seconded by Professor K. S. Curtis, Purdue University, and was passed.

There was discussion of the type of program which should be considered by the Education Division for next year's meeting.

Professor H. A. Weeden, Pennsylvania State University, asked that negative consideration be given to Professor M. O. Schmidt's paper on "Some Observations on Four Year Professional Surveying Curricula in Western Europe." Professor Weeden offered an alternative suggestion that instead of creating scholarships for U. S. students to attend Western European Universities for Geodesy and Photogrammetry, as suggested by Professor Schmidt, that he, Professor Weeden, would like to see presented something by way of an al-

ternative as to what might be done in this country.

The accreditation problem, regarding civil engineering, brought up by Professor Irish was deferred by the chairman to the Lexington, Kentucky, meeting to be held next summer.

The chairman asked for the fullest cooperation of all present to attend the National Surveying Teachers Conference to be held in August 1962 at Dahlonega, Georgia.

The officers of the Division for the coming year are:

Chairman and *Director*—John O. Eichler
Directors—Robert D. Turpin and Calvin W. Tooles
Secretary—Ralph Moore Berry
Associate Editor—John G. McEntyre

Instruments Division

The Instruments Division was responsible for the program during the latter half of the plenary session held during the afternoon of Thursday, March 23, 1961. Chairman Clifford A. Thorpe, Jr., presided.

Charles R. Manor, Assistant Chief, Surveying and Geodesy Branch, U. S. Army Engineers, GIMRADA, presented a paper entitled "A World Survey of the Surveying Instrument Industry and the U. S. Army R & D Program."

GIMRADA has made a worldwide survey of the surveying instrument production facilities to establish and maintain sources of supply for the many types of surveying, measuring, and tracking instruments and equipment required by today's Army. A domestic source is highly desirable, but does not exist at present. In fact, while there are several research and development contracts with foreign manufacturers, at present, there are none with U. S. instrument companies.

This survey included about 30 domestic firms, and 50 in Europe and Japan. There are 26 Japanese firms producing optical and surveying instruments. Most of their factories and production facilities are primitive, with hand finishing the rule, although a few concerns are installing modern equipment. Photogrammetric equipment is a major item in the Japanese industry, with thousands of items now in production. Quality of the Japanese products is well controlled and is improving.

The European surveying instrument industry has made a remarkable recovery since World War II. There are now 12 manufacturers of theodolites, and several of automatic levels. Russia is making some good instruments, but not for export to the United States, and has excellent production equipment.

The Army is converting 100 percent to optical-reading instruments, none of which are U. S. made, but about half of the U. S. instrumentmakers now distribute foreign made equipment.

"Gyroscopic Azimuth Instruments for Surveying" was the title of a paper given by Robert T. Flowe, Project Engineer, Surveying and Geodesy Branch, U. S. Army Engineers, GIMRADA.

The Army has developed a first-generation family of gyroscopic instruments to determine azimuths, suitable for artillery fire control and other purposes. Inertial guidance equipment includes a theodolite combined with a gyroscopic azimuth device. "Rate" and "pendulous" systems were illustrated and explained in Mr. Flowe's paper. The "Orienter" was described and was on exhibit. It can determine azimuths accurate to within 30 seconds to one minute. Second-generation gyro theodolites are expected to be lighter in weight and to be accurate within 20 seconds. German gyro equipment is being investigated.

A paper, "A New Master Compass," by D. R. Stanley, Director, Hilger & Watts Ltd., London, was read by Eric J. Schneider.

The Watts Master Compass is a new instrument for determining the direction of the magnetic meridian to an accuracy of one minute of arc. It is an attachment for a theodolite, to be used in the field to standardize field compasses, or in making magnetic variation surveys. Systematic and index errors are eliminated by the method of mounting and the construction of the device. The needle of the compass unit consists of two magnetized rods mounted on a double-ended sapphire bearing with two

pivots. An autocollimating telescope and mirror viewing system permits reading the magnetic bearing on a reticle scale in the focal plans of the telescope. The scale is graduated with 5-minute divisions, and readings are estimated to one minute of arc. Repeated readings with the theodolite direct and reversed remove the effect of systematic errors.

Property Surveys Division

The Property Surveys Division's participation in the Twenty-first Annual Meeting involved a very full schedule comprising the Land Surveyors' Annual National Conference (in two separate sessions), a plenary session panel discussion, the Third Annual Meeting of the Division Advisors, and a Division business meeting. In addition, there were meetings of several of the Division committees and of the Division Executive staff.

The first session of the Land Surveyors' Annual Conference, held Thursday morning, featured reports by four of the Division's standing committees. James L. Bell, Chairman of the Division, presided.

Curtis M. Brown, Chairman of the Surveyor Registration and Legislation Committee, retraced the history of ACSM's activities pursuant to the adoption of a land surveyors model law by the National Council of State Boards of Engineering Examiners, in August 1960. He cited, and read the provisions of, the Technical Standards for Property Surveys, adopted by ACSM in 1946. He stated that, during the 1960 annual meeting, his committee had met with the Land Survey Committee of NCSBEE to discuss a model law, and that, shortly thereafter, his committee had formulated and transmitted to the NCSBEE committee a set of recommended provisions for inclusion in any model law. He pointed out that the model law later adopted by NCSBEE included the recommended provisions, but that it is basically a registration act and thus does not include regulations covering the practice of surveying. He declared that the provisions with respect to registration of members of surveying corporations were objectionable. His committee recommended the approval of the NCSBEE model law, with the exception of the corporate practice provision, and recommended further study regarding the advisability of including provisions covering standards of practice.

The report of the Publications Committee, presented by Prof. Winfield H. Eldridge, Chairman, was in the form of a prepared paper entitled "The Literary Monuments in Property Surveying," in which Professor Eldridge described the Bibliography of Property Surveying being compiled by the committee and recounted some of the interesting and humorous items encountered by the committee in its search for material. The demand for such a bibliography, he explained, has grown apace with the constantly diminishing amount of material on property surveying presented in standard textbooks on surveying and with the increasing need for the surveyor to keep informed of technological advances in related fields. The committee, he stated, now has accumulated material for more than six hundred items and expects to reach one thousand or more before publication.

W. H. Matheny, Chairman of the Committee on the Surveyors Role in Land Planning, in his report which was distributed but not presented orally, recalled that the committee had presented in panel form at the 1960 meeting the results of a year-long, nationwide study of the position of the surveyor with respect to land planning. Since that report, he stated, his committee has assumed a "watchdog" status with the objectives of keeping the Division aware of the relationship between surveyors and land planners, of endeavoring to achieve recognition by the land planners of the surveyor's abilities in this field, and of establishing better relationships between the sometimes-opposing professions. He reported that informal liaison had been established with the American Institute of Planners as a step toward achievement of these goals.

Mr. Matheny then introduced W. C. Dutton, Executive Director of the American Institute of Planners, who discussed the past, present, and possible future relationships between surveyors and urban planners.

The main problems in this relationship, he said, stem from the number of both surveyors and planners who do not understand, or refuse to recognize, the roles and responsibilities of the other profession. The role of the surveyor, he believes, is as an advisor to the private client, whereas that of the planning office is, or should be, as an advisor and enforcing officer of public land policy. The function of the planning office is that of pulling together, on behalf of the government and the public interest, of the contributions of the many kinds of highly trained specialists in the field—architects, engineers, surveyors, lawyers, sanitary engineers, sociologists, and economists. Mr. Dutton concluded with a list of suggestions on actions that can be taken leading to better understanding between the two groups.

The report of the Committee on State Land Surveyor Manuals, prepared by the Chairman, W. Thompson Cox, was presented in his absence by Merlin McLaughlin, a member of the committee and President of the Virginia Association of Surveyors, Inc. The report revealed that the committee had mailed out and received answers to a questionnaire concerning manuals. The responses disclosed that only 8 out of 42 States and the District of Columbia from which replies were received have a uniform map law, that in not more than 5 States is there authorization to publish a manual, and that a majority of the land surveyors desire such manuals and believe that the State land surveyor societies should assist the State examining boards in their preparation. Mr. McLaughlin read the table of contents of the manual published by the Missouri Association of Surveyors to show the scope of coverage.

Immediately following the presentation of committee reports, five resolutions and a statement of policy, all stemming from the several committee reports, were presented. All were approved by the Division. Three, presented by Chairman Brown of the Legislative Committee, were designed to carry out recommendations of that committee: (1) a resolution endorsing the model law adopted by NCSBEE, with the exception of the section on corporate practice, and requesting that ACSM allow the Division to inform NCSBEE of its endorsement, and urging ACSM itself to make the same endorsement; (2) a resolution declaring that "common-situs" picketing is against the best interests of professional employees, the professions of engineering and surveying, and the public, and requesting ACSM to actively oppose the adoption by the United States Congress of any measures allowing such practice in the construction industry; and (3) a resolution declaring that the Division is opposed to a Labor Department ruling that rodmen, chainmen, and instrumentmen are laborers and mechanics rather than subprofessional employees, and requesting that ACSM oppose such ruling and make known to the Labor Department its opposition, with reasons. A Phillips Bill, Chairman of the Education Committee, presented resolutions as follows: (1) a recommendation that ACSM represent to the Agriculture Subcommittee of the House Appropriations Committee that surveyors in private practice constitute a highly qualified source of service, as compared with employees of county committees of the agricultural conservation program, for use in measuring crop acreage, and (2) a commendation of Prof. Paul P. Rice and the New Jersey Society of Professional Engineers for organizing a well conceived course in land surveying under its extension school program.

Victor Ghent, Chairman of the Ethics Committee, presented a policy proposal expressing the Division's opposition to competitive bidding for professional surveying services and recommending, instead, the practice of negotiating contracts. The policy defines the term *competitive bidding,* sets forth procedures for negotiating contracts, and spells out pertinent rules of professional conduct in this connection. The proposal requested permission from ACSM to publish this policy of the Division and requested ACSM as a whole to adopt the policy.

At the plenary session Thursday evening, the Division presented a panel discussion on the subject of "Part-Time Land Surveying Private Practice." Victor H. Ghent, Chairman of the Ethics Committee, presided and

presented the first panel address. He explained that it was the hope of the Ethics Committee that the panel talks and ensuing discussion would give the committee information on ways and means of promoting better understanding and better relationships between "sundowners" and those who are opposed to the practice. He pointed out that the panelists represent both sides of the question. As one who formerly engaged in "after-hours" practice, he set forth some of the rules of ethics which surveyors engaged in the practice should follow, and pointed out that the life of an employee so engaged can become a series of serious ethical burdens. He suggested that private practice employers should try to have licensed employees share in ownership of such practice, as a means of diminishing their need to seek weekend employment.

Curtis M. Brown, representing the side of the question of full-time private practice surveyors who do not engage in part-time, after-hours practice, pointed out that, despite the unendearing connotation of the term "sundowner," it includes both the desirable and the undesirable practitioners. It is the latter, he said, who cause the trouble, singling out those with inadequate knowledge posing as qualified surveyors and those with or without adequate knowledge who filch time, equipment, and office space from their employer or who solicit work through their public offices or who do not pay all legitimate business costs such as business license fees, taxes, insurance, and Social Security payments—all to gain an unfair cost advantage.

The third panelist, Morgan E. Kronk, Chief Draftsman of the People's Natural Gas Co. of Pennsylvania, as one who is engaged in "sundowning," stated his belief that, if examined in a careful and straightforward manner, there is no necessity for either animosity or misunderstanding on the question. He noted that the National Society of Professional Engineers had given attention to this subject, and read pertinent sections of that society's code of ethics. He argued that the work load capacity—in terms of hours worked per day or per week —is an individual variable, limited only by the individual's energy, enthusiasm, drive, and ambition.

Dean C. DeLaMater, the fourth panelist and a private surveyor in Michigan, emphasized two points with regard to "weekend surveyors"—that the surveys they make must be properly executed and professionally backed, and that they must be conducted in accordance with accepted standards of ethics, particularly with regard to pricing. He outlined his concept of a properly executed and backed survey and stated, with regard to fees, that unless surveyors find a better method to settle the problem of price differentials between members of the same profession working in the same area, the profession will be forced toward fixed pricing, with strict policing.

H. L. Williams, Assistant Engineer of the City of Jacksonville, Fla., was the fifth panelist. A "sundowner" himself, he questioned the fairness of criticizing and condemning the "weekend warrior" simply because his work is part-time, pointing out that some representatives of both full-time and part-time practicing adhere to no code of ethics whatever. He explained that part-time practice is often engaged in as a means of building up a clientele, establishing a reputation, and securing the necessary finances to fulfill an ambition to embark on a career of full-time practice. He read a resolution being considered by the Florida Society of Professional Land Surveyors aimed at removing restrictions against part-time surveying practice by employees of the State of Florida and its political subdivisions.

The final panel speaker, Alonzo L. Cherry, Corps of Engineers, Norfolk, Va., defended the "sundowners," particularly those whose regular employment is with Federal and State agencies, pointing out that such surveyors have learned from their regular employment the value of using more time and better equipment to secure greater accuracy than does the average practicing surveyor. The practicing surveyor, he argued, must give first consideration to quantity of work accomplished, if he is to stay in business.

At the continuation of the Land Sur-

veyors' Conference Friday morning, Division Chairman Bell announced that, in the interest of saving time, the reports of the Division Chairman and the Division Secretary would not be presented orally, inasmuch as printed copies were available. Three committee reports were given.

A. Phillips Bill, Chairman of the Committee for Education in the Land Surveying Profession, stated that all the various definitions of the word "profession" assert that one of the essential attributes of a true profession is the existence of a well recognized, curriculum-stable, university program through which candidates for the profession naturally pass. He said that the real problem of the committee involves the establishment of such a regimen with degree status, although a secondary problem involves establishment of many types of educational programs that benefit those already in practice. He suggested that a ten-man committee be formed, with representatives from each of the ACSM Divisions, charged with the active pursuit of these problems.

Victor H. Ghent, Ethics Committee Chairman, reported on progress in two of the several items the committee has under way at the moment: the establishment of professional liability insurance and the promulgation of national standards and requirements for title insurance surveys.

Regarding liability insurance, he reported that ACSM had established certain principles of ethics concerning the proper use of the insurance, and had endorsed the insurance policy offered by Victor O. Schinnerer, Inc., as being the most complete policy available. He read a progress report from J. S. Duvall of that firm which stated that the policy and rate formula had been filed in eight States, as a pilot basis for determining exposures and rates, six of which already had been approved.

On the title insurance surveys project of the committee, Mr. Ghent reported that the first year had been spent in gathering information and establishing working arrangements with a similar committee set up by the American Title Association.

The Legal Recording and Plat Filing Committee, through its representative, Elmer J. Peterson, reported that, in response to inquiries sent to the Attorneys General in each of the 50 States asking for copies of their plat laws, replies had been received from 45 States. Study of this information revealed that four of the responding States do not have any platting laws whatsoever, that many of the laws are out of date (some are as much as a hundred years old), and that they range from a single paragraph to a complete manual—all of which points to the need for standardization.

At the Third Annual Meeting of PSD Division Advisors which followed the last committee report, PSD Secretary Ghent, who presided, outlined the aim of the meeting—the submission of specific problems for discussion and action, by representatives of ACSM Local Sections and Affiliates. Many of the 14 Sections and 21 Affiliates were represented, as were several other unaffiliated surveyor groups, including a few in Canada. Several problems presented by the advisors were discussed and most were referred to existing committees for study.

At the brief business meeting which concluded the session, Secretary Ghent explained the need for an increase in ACSM dues and elicited from those present a vote of confidence regarding the Division's intention to push for an increase.

A. Phillips Bill, Chairman of the Nominating Committee, read the slate of nominees for Division offices for 1961. The following were elected by unanimous acclamation:

Chairman—W. J. Reese, Illinois
First Vice Chairman—Curtis M. Brown, California
Second Vice Chairman—W. H. Matheny, South Carolina.

The new Chairman named committee chairmen for 1961 as follows:

Education—A. Phillips Bill
Ethics—Victor H. Ghent
Fees and Salaries—Paul P. Rice
Legal Filing—Elmer J. Peterson
Legislative—Curtis M. Brown
Publications—Winfield H. Eldridge
State Manual—Prof. Clifford Bryner

Urban Planning—W. H. Matheny

He reappointed Victor H. Ghent as Division Secretary and Robert C. Eller as Associate Editor.

Property Surveys Division Panel on "Part Time Land Surveying Private Practice," Thursday evening, March 23, 1961. *Left to right*—Victor H. Ghent, Curtis M. Brown, Morgan E. Kronk, Dean C. DeLaMater, H. L. Williams, and Alonzo L. Cherry.

Topography Division

The activities of the Topography Division were distributed over three sessions, with a short business meeting included in the morning session on Friday. All sessions were presided over by Chairman Bennett G. Jones.

Harold Merrill, Federal Housing and Home Finance Agency, presented a paper entitled "Maps for Urban Planning" to open the Topography Division's portion of the Wednesday plenary session. Mr. Merrill pointed out the urgent need for up-to-date maps and plans to guide the growth and development of our rapidly expanding metropolitan and other urban areas. The "701 Program" conducted by the Urban Renewal Administration to help prevent the spread of urban blight and to accelerate the sound planning of urban area growth was described in detail. It was brought out that the various types of base maps essential to comprehensive planning are eligible project work under the program. The Act provides for matching Federal funds to assist State and local governments in (1) solving planning problems resulting from increasing concentration of population in metropolitan and other urban areas, (2) comprehensive planning for urban development by State and local governments on a continuing basis, and (3) encouraging the establishment and development of planning staffs. The Federal planning grants may not exceed 50 percent of the estimated cost of the work. Since the inauguration of the 701 Program in 1954, Congress has appropriated $16.4 million of a total authorization of $20 million. Planning assistance has been provided for approximately 1,500 small cities, counties, and communities.

Joseph Barnett, Deputy Commissioner for Engineering, Bureau of Public Roads, addressed the Congress and reported on "Progress Under the Federal-Aid Highway Program." Mr. Barnett noted that, while a few States may lag behind and others await the next apportionment of funds, the Federal-Aid Highway Program is on schedule and doing very well. Improvements were completed, or work under way, on about 60 percent of the designated 41,000 miles in the Interstate System. The importance and benefits of the national network of accurate basic control surveys, and the topographic, hydrologic, soils, and geologic surveys available in map form are recognized. Extensive use is made of topographic maps and the aerial photographs from which they are made. Better highway engineering, particularly in highway location, is a result, Aerial photographs are used for (1) direct stereoscopic examination and photographic interpretation, (2) to illustrate problems and their solutions, and (3) photogrammetrically, to obtain needed quantitative data by map compilation and measurements.

Electronic methods of surveying and methods of computation are also used in order that operations may be completed in a reasonable time.

Thomas C. Burger, U. S. Geological Survey, opened the Friday morning session of the Topography Division by presenting a paper on the "Use of the Elevation Meter in Topographic Surveying." This informative paper, illustrated with slides, described the elevation meter as a means of establishing elevations along roads, or wherever a vehicle can travel, with accuracies usually to a tolerance of one foot. On very rough roads there is some decrease in accuracy because of the constant twisting and turning, and a reduction in the speed of the vehicle to about two or three miles per hour. On good roads a day's work will encompass 50 miles of road.

Thomas M. Schaffer, Abrams Aerial Survey Corporation, then presented "The Case for Large-Scale Photogrammetric Maps." All maps, it was pointed out, are born of necessity, that is, a requirement for future action to improve a location, plan a construction project, improve assessment practices, or explore an area. Scale, contour interval, and symbolization must meet project requirements. Specific examples were given of the benefits derived from large-scale photogrammetric maps, such as the mapping of 40 square miles of Zanesville, Ohio, at the scale of 1:480 and with a two-foot contour interval. This scale provided for plotting in greater detail, more accurate scaling and measuring, and the plotting of many desirable features such as fireplugs and sidewalks. Overlays provide supplemental information or design information in an uncluttered manner. Uses of these maps include sewer design, assessing purposes, school planning, subdivision layouts, industrial expansion, recreation development, and utility distribution studies. Similar large-scale plant engineering maps and maps of industrial complexes are no less useful in depicting the maze of detail within such areas. Accuracy, clarity, and completeness of detail are the highly desirable features provided by the large-scale photogrammetric maps.

At the ensuing business meeting of the Division, Chairman Bennett G. Jones announced the election of new officers for the Topography Division. Elected to a one-year term as Chairman of the Division to succeed Mr. Jones was David Landen of the U. S. Geological Survey. Elected as Director (Federal representative) for a three-year term was Franklin K. Van Zandt of the Bureau of Land Management, and as Director (non-Federal representative), also for a three-year term, was C. Eric Storms of Aero Service Corporation. Holdover Directors, with terms expiring in 1962, are Chester Kowalczyk, U. S. Navy Hydrographic Office, and Frank C. Riley, Park Aerial Surveys, and, with terms expiring in 1963, Tom Hughes, U. S. Geological Survey, and J. E. Harwood, Virginia Department of Highways.

In accepting the chairmanship, Mr. Landen expressed his hope for more local section interest in Division activities. With the broadening of the field of topography into Antarctica, underwater contouring, and outer space, he felt that there should be no problem in promoting general interest.

R. P. Shaw, Shaw Photogrammetric Services, Inc., presented the first paper of the Friday afternoon session of the Division. This paper, "Large-Scale Mapping for Urban Purposes in Canada," described the problems encountered in mapping a vast area of 3,851,800 square miles of terrain, part of it in the frigid Arctic northland. Immediately following the year 1945 the population explosion created a sudden need for maps. The maps resulting from this sudden demand lacked uniformity and were made without a full appreciation of the real needs of the various municipalities. There was a lack of coordination between the mapmakers, the land surveyors, and the town planners. The recently formed Canadian Association of Aerial Surveyors offers some hope for better cooperation between the individual companies, improved service to the client, and improved standards and standardization of work. Closer cooperation between the client, the planner, and the surveyor can result in a product that will

not require re-doing entirely at frequent intervals in the future.

William A. Radlinski, U. S. Geological Survey, presented his paper, "Mapping of Antarctica." Only a small fraction of the six million square miles of Antarctica is adequately mapped, yet topographic maps are urgently needed for scientific explorations and studies. The U. S. Geological Survey, in cooperation with the National Science Foundation and the Department of Defense, is engaged in an Antarctic mapping program designed to satisfy initially the needs for relatively large-scale maps of selected high-priority areas, and ultimately a requirement for 1:1,000,000-scale maps of the entire area. Unusual conditions prevail on the continent where Pole Station temperatures as low as minus 104 degrees Fahrenheit have been recorded and year-round temperatures average minus 60 degrees Fahrenheit. Snow and ice is as much as 3,000 meters deep and mountains 5,100 meters high. In addition to the scientific benefits, mapping of the Antarctic has the excitement and appeal of exploration for those engaged in it. New mountains are discovered, others supposed to exist are proved to be nonexistent, previously accepted elevations are determined to be hundreds of feet in error, and ice shelves are found to extend far beyond original estimates. All these findings add something new to man's knowledge of the earth.

Robert O. Maxson, U. S. Geological Survey, discussed "Topographic Surveys for the American Economy." He presented the findings of an intensive study, conducted since 1958 by the Topoghaphic Division of the U. S. Geological Survey, of the use of topographic maps by almost 2,000 users. The purpose and need for map-use research were discussed and the methods and scope of the study set forth. Findings of this study deal with the users and the uses of topographic maps, the value of topographic maps, and the requirements of the map users.

Business Meeting

The 21st Annual Business Meeting of the ACSM was held during the latter part of the afternoon of March 24, 1961, in the Main Ballroom of the Shoreham Hotel, Washington, D. C. The first order of business was the call for reports from the Divisions. Four Divisions responded with reports, but, because these consisted chiefly of material already reported under Division headings above, they will not be included here.

REPORTS OF LOCAL SECTIONS

Clyde Armstrong reported for the Arizona Section: It is our intent to have as nearly as possible as complete a regional conference as we have ever had on the West Coast. We certainly want to take this opportunity to extend an invitation to each and every member to attend. The regional conference will be held October 18–21, 1961, at the Hotel Westward Ho in Phoenix, Arizona. We sincerely hope that each and every member can see his way clear to attend.

Gordon Stine reported for the St. Louis Section: The Section has had a very profitable year. There are 187 members in the Section, we have had four technical meetings during the year. One business meeting had an attendance of over 80 persons. We are working on plans, in cooperation with the local group of the American Society of Photogrammetry, to put on a semiannual meeting in St. Louis, Missouri, September 9–14, 1962. This will be a joint effort.

REPORT ON FIG

George C. Bestor, Past President, ACSM, reported as follows:

The 10th Congress of F. I. G., which was scheduled for Vienna in late August and early September of this year, was postponed one year by the Austrian Committee that is handling that meeting. It is now scheduled to be held from about August 25th to the 4th or 5th of September in 1962.

Prior to that we are having a meeting of the Permanent Committee in Bern, Switzerland, this coming June, and a delegation from ACSM will go over there to help in planning next year's meeting.

For those who are not familiar with F. I. G., the meetings are quite similar to what we have had here this week, but on an

international basis. I do hope there will be a good representation of members from the ACSM at Vienna in August of '62.

AWARDS

Brother Barry announced that the Keuffel & Esser Fellowship in Surveying had been awarded to James L. Clapp, a graduate student in surveying and mapping at the University of Wisconsin. Because Mr. Clapp, for good and sufficient reasons, was not able to be present to accept the award in person, it was presented to Professor Eldon C. Wagner and accepted by him on behalf of Mr. Clapp.

The Wild-Heerbrugg Award was presented by Dr. A. J. Schmidheini of Heerbrugg, Switzerland, to Andrew Nagy of Bridgeville, Pa. Dr. W. A. Heiskanen, of the Institute of Geodesy, Photogrammetry and Cartography of The Ohio State University, accepted the $250.00 cash award—a part of the Wild-Heerbrugg Award—on behalf of The Ohio State University, the School chosen by Mr. Nagy for that part of the award.

More information concerning the above awards will be found elsewhere in this issue of SURVEYING AND MAPPING. —EDITOR

Robert J. Beaton, Chairman, Cartography Division, announced two awards by that Division.

The first went to John S. Keates, Lecturer in Geography, Glasgow, Scotland, for his paper "Techniques of Relief Representation."

The second award was made to George M. Goldberg of the Chance-Vaught Corporation of Texas, for a paper dealing with a method of getting quantitative data from gross sources.

I. C. A.

Mr. Beaton then reported on the International Cartographic Association, giving a brief history of its formation and its aims. Much of this has already been published in one form or another in SURVEYING AND MAPPING in the past and some of the material has been included under "Cartography Division" in the "Congress News" department in this issue.

TREASURER'S REPORT

Captain Henry W. Hemple, Treasurer, was not present at the Annual Business Meeting, because of illness, but the Annual Financial Statement was published in the March 1961 issue of SURVEYING AND MAPPING, page 131, and shows the financial situation as of December 31, 1960.

REPORT OF MEMBERSHIP COMMITTEE

The individual membership of the Congress for 1960 was 5721, the library membership plus the subscribers amounted to 710, making a total of 6431.

During 1960 the Congress obtained 971 new members, but lost 450 through death, resignations, and delinquency. This restricted the net gain to 521. Percentagewise the loss amounts to 7.9 percent of the membership. This compares with 7.5 percent in each of the two previous years.

I would like to take this opportunity to comment briefly on a problem closely related to membership. Most of you know that the ACSM is pretty much a volunteer organization. Largely due to voluntary efforts the Congress has been able to hold annual dues to $5.00, while at the same time building up a sizeable financial reserve.

With the growth of the ACSM additional burdens have been placed on the volunteer staff members who, for the most part, are now devoting more time to the work of the Congrees than they had originally planned or felt they could afford.

This situation, with its resulting problems, is becoming increasingly burdensome and is bound to reach a critical stage before long. Loss of the services of any of the volunteers would handicap the work of the staff and could, conceivably, do permanent harm to the Congress and its highly regarded Journal.

I simply bring this matter to you that you may be cognizant of a situation which seems to demand specific action. In the early years of the ACSM, volunteer service laid the foundation which served the Congress well. But it now appears to me, as a charter member, past president, and currently your membership chairman, that the Congress should now consider very seriously

an operating group more in keeping with its increased size. —F. S. BORDEN

RESOLUTIONS

During the Annual Business Meeting, in the afternoon of March 24, 1961, four resolutions were adopted by the ACSM, as follows:

(1) A Resolution, directed to the President of the United States, urging support of basic surveying and mapping programs.

(2) A Resolution protesting legislation legalizing common-situs picketing (secondary boycott).

(3) A Resolution, directed to the U. S. House of Representatives Appropriations Committee Subcommittee on Agriculture, on the merit of using services of private surveyors and engineers.

(4) A Resolution, directed to the U. S. Department of Labor, on description or classification of the survey-party titles *rodmen, chainmen, and instrumentmen.*

The Board of Direction of the ACSM having directed that these resolutions be published in the ACSM Journal, SURVEYING AND MAPPING, at the earliest possible date, the full text of the four resolutions is given below.

Resolution of the 21st Annual Meeting of the American Congress on Surveying and Mapping, March 24, 1961, directed to the attention of the President of the United States:

WHEREAS 17 separate investigations authorized by the Presidents of the United States and the Congresses since 1843 have expressed consistently the need for adequate Federal surveying and mapping programs to provide basic geodetic and topographic data; and.

WHEREAS the U. S. Presidential Advisory Committee on Water Resources Policy of 1955 recommended the completion within certain periods of years of basic geodetic control surveys and basic topographic mapping and other kinds of surveys for the Nation; and,

WHEREAS the U. S. Presidential Advisory Committee on Minerals Policy of 1954 recommended the acceleration of the basic surveying and mapping programs of the Federal Government; and,

WHEREAS the multi-billion dollar Interstate Highway Program was conceived and commenced without benefit of adequate surveys and maps for planning; and,

WHEREAS the American Institute of Planners in 1961 expressed an urgent need for maps of urban and city areas at a scale of 1: 24,000 for general planning purposes, as well as certain maps at several larger scales, for more detailed planning relative to social, economic, and cultural development; and,

WHEREAS in the U. S. President's Special Message to Congress on Housing and Community Development he stressed the importance of urban development, urban renewal, and metropolitan redevelopment, which for efficient, economical, and intelligent planning requires up-to-date and accurate survey map data before final planning is completed and development commences; and,

WHEREAS many eminent organizations, including the U. S. Chamber of Commerce and the American Society of Civil Engineers, have stressed repeatedly the importance of having basic surveys and maps of our country;

WE DO THEREFORE HEREBY RESOLVE that we do once again clearly and resolutely affirm the need at a very early date to complete basic surveys and maps of the United States and its outlying areas of sovereignty and jurisdiction, without which surveys and maps efficient, economical, and intelligent national plans, projects, and programs cannot be accomplished.

BROTHER B. AUSTIN BARRY, F.S.C.
President, A.C.S.M.
WALTER S. DIX
Executive Secretary, A.C.S.M.

Resolution, directed to the attention of the 87th Congress of the United States, protesting legislation legalizing common-situs picketing (secondary boycott).

WHEREAS during 1960 at least two bills were introduced into the United States Congress (S. 2643, H.R. 9070) which would have allowed "Common-Situs Picketing" or "Secondary Boycott" in the construction industry, and

WHEREAS it appears that this legislation would permit the shutdown of any construction project without due regard for the rights and liberties of individuals guaranteed under the Constitution, and

WHEREAS it further appears that the rights of the professional and subprofessional elements of the construction industry to "self determination" would be destroyed by this legislation,

NOW THEREFORE BE IT RESOLVED that the A. C. S. M. is opposed to this legislation and that action be taken by this body to actively oppose any such measures introduced in the Congress of the United States.

I hereby certify that the above resolution was adopted by the 21st Annual Convention of the American Congress on Surveying and Mapping on March 24, 1961, in session at the Shoreham Hotel in Washington, D. C.

For ACSM: W. S. Dix, *Executive Secretary*

Note.—The above-mentioned 1960 Bills became dead with the close of the 86th Congress and if introduced to the present 87th Congress will have new numbers.

Resolution, directed to the U. S. House of Representatives Appropriations Committee Subcommittee on Agriculture, on the merit of using services of private surveyors and engineers.

Whereas the Agriculture Subcommittee of the House Appropriations Committee of the United States Congress has indicated that full hearings will be held on the merit of using private surveyors and engineers to furnish services now being performed by employees of county committees of the agriculture conservation program; and,

Whereas the ACSM believes that all citizens should have the right to have services performed by licensed surveyors and engineers of their choice and that this highly qualified source of professional people licensed by the various States should be recognized and be acceptable to the U. S. Department of Agriculture,

Be It Hereby Resolved that the American Congress on Surveying and Mapping strongly represent to the above-mentioned committee that licensed surveyors and engineers in private practice constitute a highly qualified source of service in this regard.

The above resolution was approved in annual convention March 24, 1961, at the 21st Annual Meeting of the American Congress on Surveying and Mapping.

For ACSM: W. S. Dix, *Executive Secretary*

A Resolution, directed to the U. S. Department of Labor, on its ruling regarding the status of Rodmen, Chainmen, and Instrumentmen:

Whereas the U. S. Department of Labor on June 29, 1960, held that, under the Davis-Bacon Act, rodmen, chainmen, and instrumentmen whose work is largely of a physical nature such as clearing brush, sharpening and setting stakes, handling the rod and tape, and other comparable activities are laborers and mechanics within the meaning of the act; and,

Whereas it is the view of the ACSM that such survey-party personnel are more accurately identified and regarded by the engineering and surveying professions as subprofessional employees rather than laborers and mechanics; and that quite often "recent" engineering and surveying graduates are employed in survey-crew positions in the early years of their practice and that classifying them as "laborers and mechanics" can have a most detrimental influence upon their career and their choice of career; and that rodmen, chainmen, and instrumentmen must have the technical knowledge and basic understanding of the engineering and surveying principles involved to perform the work;

Now Therefore Be It Resolved that the American Congress on Surveying and Mapping is opposed to such ruling and hereby requests the U. S. Department of Labor to reconsider and rescind its action and to classify such personnel as subprofessionals.

Above resolution approved in convention of ACSM 21st Annual Meeting, March 24, 1961, at the Shoreham Hotel in Washington, D. C.

For ACSM: W. S. Dix, *Executive Secretary*

ACSM members are urged to support the the above resolutions by writing or otherwise contacting their respective congressmen at the House of Representatives or the Senate of the United States at Washington 25, D. C.

EXECUTIVE SECRETARY'S REPORT

Briefly, since the last annual meeting we have had the Southwestern Regional Conference at Austin, Texas, and all who attended will agree that it was a success; we have instituted the Keuffel & Esser and the Wild-Heerbrugg awards; we have moved the Central Office from the Washington Building to the Woodward Building in somewhat closer consolidation of our three-man-plus-a-small-staff operation; through the efforts of the historical group in East Liverpool, Ohio, we finally monumented the good old "Point of Beginning;" and, as you all know, Alaska has effected a professional land surveyors group now affiliated with the ACSM; The Delaware Valley Section has been officially organized; and there is currently strong action in Kansas City for the formation of a new Section there. It has been a good year. —Walter S. Dix

REPORT OF TELLERS

The Executive Secretary reported for the

tellers, and announced the election of the following:

President—Brother B. Austin Barry
Vice President—Walter S. Dix
Directors (two-year terms)—
James L. Bell, Kansas
A. Phillips Bill, Massachusetts
Frank Clements, Missouri
Granville K. Emminizer, Maryland
Clifford A. Thorpe, Jr., Virginia

Admiral Karo reviewed briefly the accomplishments of the past year, thanked all of the people who helped make his administration the success it was, and, pledging his support to the new President, turned the meeting over to Brother Austin Barry.

Brother Barry spoke briefly as incoming President and asked the cooperation of all in his efforts to bring the Congress through another successful year.

Executive Secretary Dix then formally closed the ASP-ACSM Convention and the 21st Annual Meeting of the ACSM at 5:30 p.m., March 24, 1961.

Social Activities

EDITOR'S NOTE.—As for some years in the past, we are again indebted to Mrs. Frank Borden for this report on the social activities of the 1961 ASP–ACSM Consecutive meetings.

Programs planned with the ladies in mind seem to increase in interest and in entertainment value with each succeeding annual meeting of the two societies. This year was no exception as many new features were added.

At a coffee hour on Monday morning, the women gathered in booths and at tables for the social period presided over by the honorary hostesses, Mrs. Garrett Tewinkel and Mrs. Arnold Karo, wives of the presidents of the ASP and the ACSM, respectively. A representative of Scandinavian Air Lines presented colorful films taken all over the world. Scenes showing places which had actually been visited by ladies present were greeted with especial delight.

Following this, a bus took passengers to the National Housing Center which displays many modern adjuncts to easy living. Later, stops were made at the several embassies listed on the tour program. At the Israeli, Chinese, and Japanese headquarters the visitors were graciously received and shown items of special interest peculiar to each of these three countries.

Monday evening both men and women joined in the usual "home-coming" cocktail party. There is a fine spirit of camaraderie among the members of the two societies, and this annual affair helps to promote such an atmosphere.

Tuesday a bus took the ladies on a tour of Olde Georgetown, with lunch at the historic Carriage House.

A visit to Annapolis and the U. S. Naval Academy was on Wednesday's entertainment schedule. Lunch was enjoyed at Carvel Hall, an old inn long known for its hospitality and excellent cuisine.

The Grand Banquet, traditionally a midweek feature, brought out over 900 guests and was, really, a gala affair. After dinner the floor show was enthusiastically received. A banjo player exhibited many unique and surprising ways of getting music from this instrument. A turbaned magician played fast and loose with currency commandeered from somewhat worried guests. However, it was returned intact, along with sundry items purloined from unsuspecting guests who were not even aware of their losses. An attractive trio of youthful sisters sang numbers which were so briskly applauded as to demand many encores.

Very desirable door prizes were awarded to those holding the lucky tickets. These prizes included the much-prized globes, drawing equipment, and other articles most useful to the professions represented.

On Thursday a tour of the Capitol was made. The tour was conducted by one of the best informed guides of the staff. She was able to furnish glimpses of areas not usually visited and tell unpublicized tales of Capitol history. Luncheon was served in the old Supreme Court quarters, scene of the post-inaugural repast served January 20th!

On Friday a very special tour of the White House was made available. This preceded the regular public visiting hours.

The ladies were shown items not generally on view and told interesting details of White House life.

This was followed by a trip to the headquarters of a prominent Washington newspaper, where steps in its publication were shown and explained.

The dance, the usual finale to the week of activities, was colorful and drew a banner crowd.

The consensus among all those who enjoyed these various events was that the entertainment committee had been tireless in making the week's social sessions happy and memorable for all who participated.

Exhibits

The seventh combined ASP-ACSM exhibit was officially opened at 11:00 a.m., March 21, and closed at 8:00 p.m., March 23, 1961. One hundred thirty-two exhibit spaces were available, all in one area as in the years 1958 to 1960, inc. There were 60 commercial exhibits and 23 educational exhibits. Of the total of 83 exhibits, 33 occupied two or more exhibit spaces, some as many as four.

The commercial exhibitors taking part in the 1961 ASP-ACSM exhibit were as follows:

Abrams Aerial Survey Corporation, Lansing, Mich.
Abrams Instrument Corporation, Lansing, Mich.
Aero Service Corporation, Philadelphia, Pa.
Aeroflex Corporation, Long Island City, N. Y.
AGA Corporation of America, South Plainfield, N. J.
AGA Svenska AB Gasaccumulator, Stockholm-Lidingo, Sweden
Art-O-Graph Incorporated, Minneapolis, Minn.
Askania-Werke, Bethesda, Md.
Bausch & Lomb Incorporated, Rochester, N. Y.
Belfort Instrument Company Baltimore, Md.
Buff & Buff Manufacturing Co., Jamaica Plain, Mass.
Canadian Applied Research Limited, Ontario, Canada
Charles Bruning Company, Inc., Mt. Prospect, Ill.
Concord Control Inc., Boston, Mass.
Continental Engineers, Inc., Denver, Colo.
Cooke Troughton & Simms, Inc., Malden, Mass.
Cooper Trent Incorporated, Washington, D. C.
Cubic Corporation, San Diego, Calif.
Decca Navigator System, Inc., Washington, D. C.
Di-Noc Chemical Arts, Inc., Cleveland, Ohio
Direct Reproduction Corporation, Brooklyn, N. Y.
Eastman Kodak Company, Washington, D. C.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
Eugene Dietzgen Co., Chicago, Ill.
Fennel Instrument Corp. of America, Clifton, N. J.
Ferranti Electric Inc., Hempstead, N. Y.
Frederick Post Company, Chicago, Ill.
Galileo Corporation of America, New York, N. Y.
Gallant Incorporated, Washington, D. C.
General Aniline & Film Corporation, Binghamton, N. Y.
The Geodimeter Company, South Plainfield, N. J.
George F. Muth Company, Inc., Washington, D. C.
Hastings-Raydist, Incorporated, Hampton, Va.
Information Technology Laboratories, Waltham, Mass.
Isis Incorporated, York, Pa.
Jack Ammann, Inc., San Antonio, Tex.
J. G. Saltzman, Inc., New York, N. Y.
The Kelsh Instrument Co., Inc., Baltimore, Md.
Kern Instruments, Inc., White Plains, N. Y.
Keuffel & Esser Company, Hoboken, N. J.
Koh-I-Noor Pencil Company, Inc., Bloomsbury, N. J.
Kreonite, Inc., Wichita, Kans.
Logetronics Incorporated, Alexandria, Va.
Lufkin Rule Company, Saginaw, Mich.
Monsen Typographers, Inc., Chicago, Ill.
O.M.I. Corporation of America, Alexandria, Va.
Photogrammetry, Inc., Silver Spring, Md.
Repro Graphic Machines, Inc., New York, N. Y.
Richards Corporation, Arlington, Va.
Seiscor Manufacturing Co., Tulsa, Okla.
Technical Advisors, Inc., Ann Arbor, Mich.

Tellurometer Inc., Washington, D. C.
Transmares Corporation, New York, N. Y.
Union Instrument Corporation, Plainfield, N. J.
Unitech Corporation, Clifton, N. J.
Wallace & Tiernan Incorporated, Belleville, N. J.
Watson Electronics & Engineering Co., Inc., Arlington, Va.
Wild-Heerbrugg Instruments, Inc., Port Washington, N. Y.
W. & L. E. Gurley, Troy, N. Y.
Zeiss Aerotopograph, Munich, Germany

Educational exhibits were sponsored by the following organizations:

The Library of Congress, Washington, D. C.
Maryland National Capital Park and Planning Commission, Silver Spring, Md.
National Geographic Society, Washington, D. C.
The Ohio State University, Division of Geodetic Science, Columbus, Ohio
The University of Illinois, Department of Engineering, Urbana, Ill.
Department of Agriculture
- Forest Service, Washington, D. C.
- Soil Conservation Service, Cartographic Division, Beltsville, Md.

Department of the Air Force
- Aeronautical Chart and Information Center, St. Louis, Mo.
- Air Photographic and Charting Service, Orlando Air Force Base, Fla.
- Directorate of Intelligence and Electronic Warfare, Air Research and Development Command, Griffiss Air Force Base, Rome, N. Y.

Department of the Army
- Corps of Engineers, Army Map Service, Washington, D. C.
- U. S. Army Engineers School, Corps of Engineers, Fort Belvoir, Va.
- Corps of Engineers, Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
- U. S. Army Intelligence Center, Fort Holabird, Baltimore, Md.

Department of Commerce
- Bureau of Public Roads, Washington, D. C.
- Coast and Geodetic Survey, Washington, D. C.
- National Bureau of Standards, Washington, D. C.

Department of the Interior
- Geological Survey, Washington, D. C.

Department of the Navy
- Aeronautical Photographic Experimental Laboratory, Johnsville, Pa.
- Naval Photographic Center, Washington, D. C.
- Naval Photographic Interpretation Center, Suitland, Md.
- Naval Ordnance Laboratory, White Oak, Silver Spring, Md.
- Navy Hydrographic Office, Suitland, Md.

Analytic Aerotriangulation

A "breakthrough" in mapping techniques, which promises to make aerial surveys three to four times more accurate than at present, has been accomplished by scientists of the Coast and Geodetic Survey.

A new procedure, known as "analytic aerotriangulation," mathematically controls aerial photographs more rigidly to permit better map compilation. This is believed to be the first time that a complete mathematical system with extremely high standards of accuracy has been accomplished by any mapping agency in the world. The principle of the system has been known since the birth of photogrammetry, but what is new is the unique combination of complex mathematical equations, precise photogrammetric instruments, and high-speed electronic computers into a practical and workable procedure.

In recent tests of photographs taken at 20,000 feet and using the new interpretive system, errors in positions and elevations were reduced from the normal 10 to 12 feet to approximately 3 feet in actual ground measurement.

An important part of the new system is a precise comparator which measures positions on the aerial photographs to the nearest micron. The measured readings are transmitted to an electronic "read-out" instrument for review by the operator and simultaneously recorded on a perforated tape. The tape is fed into a machine which converts the data to IBM punch cards. It is at this point that electronic computers take over and through the unique application of existing equations the correct positions and elevations are computed from the data.

Western Regional Conference—1961

The Arizona Section of the American Congress on Surveying and Mapping cordially invites you to attend the big Western roundup to be held in Phoenix, Arizona, October 18–21, 1961. This is the 1961 Western Regional Conference of the ACSM.

This event will be held at the Westward Ho Hotel, one of the finest and largest in Phoenix. We plan to make it a pleasant combination of exchange of technical technical information, interesting exhibits, and an opportunity for a short Fall vacation in a pleasant and informal Western atmosphere.

The technical program will include papers and discussion groups by prominent professional people, known as experts in their field.

The entertainment committee plans tours of such points of interest as Pueblo Grande Ruins, Heard Museum, Salt River dams, and others. Also an authentic Western cowboy dinner on the sunlit Arizona desert. The ladies' program promises to be unusual and entertaining.

Take a Fall break and attend our Western Regional Conference.

ROBERT L. FRAZER, *Chairman*
Arizona Section, A.C.S.M.
CLYDE L. ARMSTRONG
General Conference Chairman

Relief Map of Tennessee Valley

The Tennessee Valley Authority, in a release dated April 19, 1961, announced that the price of its three-dimensional, relief map of the Tennessee Valley area has been reduced from $20 to $10. The reduction in price is possible because enough maps have been sold to assure recovery of production costs, even at the reduced price.

The relief map is 30×50 inches and is printed in six colors on plastic material. State lines and names, cities, principal railroads, streams, and highways are shown.

The Tennessee River basin is in three dimensions with a horizontal scale of 1 inch equals 10 miles. Mountains, hills, and valleys stand out sharply. The Valley area is colored in a greenish yellow, with the surrounding region in a darker green. A brown frame, formed from the plastic sheeting on which the map is printed, surrounds the map.

Copies of the map may be obtained from Map Library, Tennessee Valley Authority, Pound Building, Chattanooga, Tenn., or from the Map and Engineering Record Services, Tennessee Valley Authority, Union Building, Knoxville, Tenn.

Spotlight on Surveyors

On the New Frontier

By late in May 1961 most of the members of the ACSM had received President Kennedy's Peace Corps recruitment papers seeking qualified surveyors for the first Peace Corps group to be sent out, the one to Tanganyika. That group will be composed of twenty-four surveyors, four civil engineers, and two geologists. As a former president of ACSM, George C. Bestor points out that this fact alone builds up the status of the surveying profession in a significant way.

In Space

We find, from an item in the May 1961 issue of *Signal*, that the National Aeronautics and Space Administration plans to launch seven Surveyor spacecraft in the 1963–65 period. Each of these Surveyor spacecraft will carry four television cameras to send pictures of the moon's surface back to the earth. The cameras will be turned on automatically as the Surveyors approach the moon and will send back pictures at the rate of one every few seconds.

The Jet Propulsion Laboratory of the California Institute of Technology will provide technical direction for the project, which is expected to cost upwards of $50 million.

Circle Accuracy, Its Value to the Engineer and the Economy of Its Use

By PHILIP KISSAM

PROFESSOR OF CIVIL ENGINEERING, PRINCETON UNIVERSITY

EDITOR'S NOTE: It may seem at first glance that this paper was a long time in reaching the printed page. However, although this paper was presented in March 1959, it was the subject of a considerable amount of correspondence the last item of which was dated May 5, 1960. The paper reached the editor on May 27, 1960, and since that time has been "waiting in line," so to speak.

IN THIS DAY of great technical achievement, the output of the individual is increasing rapidly in nearly every form of human endeavor. The value of wealth or consumers' goods that a man can create with a machine increases daily. It follows that the cost of his time is growing faster than the cost of the products he produces. To put it bluntly, the cost of labor has gone up and will continue to increase faster than the cost of anything else.

This single fact has replaced restaurants with cafeterias, stores served by clerks with supermarkets with no clerks at all, parking lot attendants with parking meters, and, in fact, has changed nearly every facet of our daily life—even to replacing the plane table with air mapping.

There is a great field of surveying, however, which apparently cannot be mechanized. It is the kind of surveying that is dominated by the transit and the steel tape; the kind of surveying that results in driving a stake and setting a tack in the place where the tack should be. When one stops to think about it, most of the magnificent devices exhibited here today are only a means of preparing the way for the transit and tape. They really carry out only a very small part of the whole project of setting those tacks where they belong.

This fundamental operation of using the transit and tape must consume at least 90 percent of our surveying dollars. And yet it is, of necessity, accomplished almost entirely by hand. Accordingly, as we all know, the cost of this kind of work has soared. Every field party that handles a transit and tape has become an expensive jewel among the other elements of an engineer's province. It must be trained and equipped to work surely, accurately, and rapidly. Probably the most ridiculous form of economy today is to supply the field party with poor equipment. It seems to your speaker that the difficult decision today is not whether or not to buy a good instrument but which is the best instrument that can be obtained.

THE CHOICE OF A TRANSIT

There are many features of a transit that must be considered in its purchase. Some are more important than others. Certain features can be evaluated by merely looking at the instrument, others may be determined by simple tests, and some must await many hours of field use before their qualities are known. But there is one part of the instrument that, if regarded at all, is merely examined for its appearance. Its accuracy seems to be taken for granted, and it is almost never evaluated. And yet it is the very heart of the instrument. This is the *circle*.

When angles do not add up properly, when curves do not check out, when layout work will not tie in; who gets the blames? The transitman. Not the circle. Never the

Presented at the 19th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 11–13, 1959.

circle. Only the poor man who has put his eyes out and worn his nerves to a frazzle checking the coincidence of the vernier or the miocrometer.

With a poor circle, the best instrumentman in the world is helpless. No matter how hard he tries, he can never make up for the circle deficiencies. His only recourse is to repeat the angle as many times or to use as many circle positions as may be necessary to attain the accuracy for which he is responsible. And what happens to the field party while this is going on? First they sit down to swap stories and next they go off for a coke. What employer would stand for a transitman who, after he has set off a right angle or a deflection angle, must repeat the operation several times to get it right?

It seems obvious that the first test that should be made on an instrument would be a test of the circle. And yet this is seldom attempted. It is all very well to buy an instrument from a reputable manufacturer. This is a most important consideration, but remember, no two engine-divided circles are alike and no two circles reproduced by photography are centered on the instrument in exactly the same place. The problem of manufacturing and mounting a circle is not a simple one. No circle is perfect, and many of them, of necessity, contains sizeable errors. F. R. Gossett, in United States Coast and Geodetic Survey Special Publication No. 247, says, ". . . the *mean* curve for the variations of graduations for a first-order circle, as determined from field observations, should not have a range greater than 3.5 seconds." If such a *mean* curve can be expected in a first-order theodolite, individual graduations could well be in error by 20 seconds in an ordinary transit yet pass the manufacturer's inspection.

Let us stop for a moment to consider how accurately the graduations on a circle must be placed. One second or arc is about five millionths of a radian. On a six-inch circle, which has a radius of three inches, this amounts to 15 millionths of an inch; on a three-inch circle, half of this amount. In addition, the circle must be mounted to twice the accuracy of the graduations to avoid an equal error due to eccentricity.

If circles are so difficult to manufacture, surely the purchaser should check this part of his instrument with great care. It is a comparatively easy operation to check a circle. A good transitman can check out a circle on a rainy day in his own cellar in less than one hundred minutes. The results will show the maximum errors, the eccentricity of the circle, and the maximum deviations of the graduations. It takes a skillful transitman to test the circle of an American transit but certainly no superman is needed. A theodolite can be checked out by anyone who is thoroughly competent to operate it. In either case no special equipment is required other than the instrument itself. There are many methods of making such a check. It is proposed here to outline a simple method that is easy to perform and yet one which will determine the maximum extent of any faults the circle may have.

TEST OF A CIRCLE

The first step in checking a circle is to put a small white card on the drafting board. With a pen set to draw a fine line, draw a black horizontal line across the card; and at right angles to this horizontal line draw several pairs of short vertical lines across it. (*See* Figure 1.) The two lines of each pair

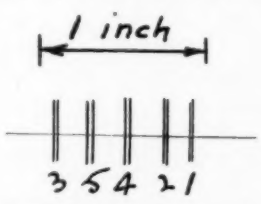

FIGURE 1.—The target used.

should be drawn with very small but different widths of white space between them. The pairs should be numbered so that they can be recognized.

Set up the transit or theodolite on the cellar floor, level the telescope and mount the card with a thumbtack at approximately the height of the line of sight. Arrange a light to illuminate the card brightly and well

shaded from the instrument. Turn the card until the horizontal line is parallel to the horizontal crosshair in the telescope and fasten the card with another thumbtack.

Try aiming the telescope at the different pairs of lines and select the pair that apparently gives the most certain point of aim. Usually this will be the pair that is so spaced that the vertical crosshair can be placed between the lines so that the white spaces on each side of the crosshair are about equal in width to the apparent width of the crosshair itself. This will be nearly the best target that can be designed.

A perfect target consists of a pair of lines so spaced that the two white spaces each side of the crosshair are between 2½ seconds and 7 seconds in width, and the black lines are about 3 times as wide as each white space and about 12 times as long as the width of each white space. Since most crosshairs are between 2½ and 3 seconds wide in the field of view, they can serve as measuring devices. The probable error of pointing at such a target is about ±0.15 seconds.

With an American transit proceed as follows:

Rig an electric light so that it will brightly illuminate the A vernier when the transit is pointed at the target with the telescope direct.

1. Set the A vernier at exactly zero.

2. Read the error of the B vernier, calling clockwise errors plus. With a one-minute instrument, the error can be read to 15 seconds; with a 30-second or 20-second instrument, the error can be read to 10 seconds.

This is not as difficult as might be supposed. With a one-minute instrument, if there is a coincidence, there is no problem. If two vernier lines fall between two circle graduations, it is necessary to judge one of three positions. If they are exactly in the middle, the reading is 30 seconds. If they are to the right of the middle, 15 seconds is indicated (for a clockwise angle); to the left of the middle, 45 seconds. (*See* Figure 2.)

With a 30-second instrument, under the same conditions, to the right indicates 10 seconds; to the left, 20 seconds. With a 20-second instrument, when neither line coincides, 10 seconds is indicated.

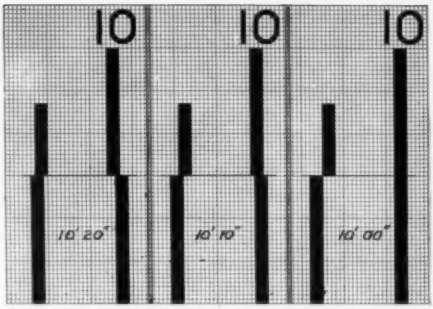

FIGURE 2.—The method of reading verniers.

3. Having read the B vernier, aim at the target with the *lower* motion.

4. Reverse the telescope and aim at the target with the *upper* motion.

5. Read the angles indicated by the two verniers, by the methods described.

This process measures a particular angle. It is the angle 180° minus twice the error of collimation.

The difference between the two A-vernier readings is recorded and also the difference between the two B-vernier readings. Thus we have an A determination and a B determination. The A reading applies to the part of the circle from 0° to 180°, the B reading applies to the part of the circle from 180° to 360°. Later these are regrouped by finding the angle measured when the B vernier traveled from 0° to 180° and averaging it with the value obtained when the A vernier traveled from 0° to 180,° etc.

The procedure is repeated starting with 30°, then 60°, etc., up to 330°. This completes one set and takes about 40 minutes of time.

Since both the A determinations and the B determinations have been carried all the way around the circle, each part of the circle has been used to measure the angle twice.

A second set should be run to give a better average for the results. When the second set is complete, the angle has been measured four times with each of 12 different parts of the circle or a total of 48 times. The aver-

age of these 48 determinations is certainly close to the true angle, irrespective of any circle errors.

The four determinations of the angle by each particular circle part are averaged. That is to say, the angles recorded when the B vernier traveled, for example, from 30° to 210° are averaged with the angles recorded when the A vernier traveled from 30° to 210°, etc.

This eliminates most of the errors of reading. From each of these 12 averages is subtracted the true angle. This gives the error of measuring the angle on each of the 12 parts of the circle. This is the chief result desired. If these 12 errors are plotted and joined by straight lines they are easy to study.

When an optical-reading theodolite is used, the procedure is almost exactly the same but much easier. Since most of these instruments are self-illuminated, no light need be rigged to illuminate the reading device. Since it is much easier to estimate seconds with a micrometer than to set the desired initial reading, the value of the initial reading is read with the micrometer after it has been set approximately. Finally, if the instrument automatically averages the A and B readings, the B readings are omitted. If there is no means of reading the B positions, they are omitted and four sets are run.

DEFENSE OF THE METHOD

It may be said that a collimator should be used instead of the homemade target. There is no fundamental reason for a collimator. It is true that the line of sight of the theodolite may not be quite centered over the vertical axis of the alidade so that it is slightly eccentric. This eccentricity is eliminated automatically when the collimation error is eliminated.

Actually two arguments can be proffered against the use of a collimator. It may rotate slightly during an angle measurement and thus change the value of the angle. Of course, the instrument might do the same thing, but at least one possibility is eliminated. Also, unless the collimator has a reticle with a pair of lines about 10 seconds apart, it is not as good a signal as the homemade target.

It might be said that the method of reading the circle is not accurate. Actually, since four readings are taken for each determination, the probable error is half that of reading the circle in practice. Moreover, if more accuracy is required, another forty minutes can be spent to observe another set.

ECCENTRICITY

The method has another advantage. If the effect of eccentricity of the circle is desired, the method determines it quite accurately. The effect of eccentricity is certainly very important if the B vernier is not read in practice, or if the instrument is a theodolite that neither averages the two positions nor provides a second micrometer microscope.

The condition of eccentricity exists when the center of the graduations on a circle is not on the axis of rotation of the alidade. The effect of eccentricity is zero at that point on the circle which is intersected by an imaginary line drawn from the axis of rotation through the center of graduations and extended. The effect of eccentricity, if not compensated in the instrument or by the method of observing, varies as the sine of the angle measured from this line to the point on the circle considered. Thus the greatest plus error, caused by eccentricity, occurs at 90° from that line, and the greatest minus error occurs at 270° from that line. It follows that the greatest error in measuring an angle will occur when an angle of 180° is measured from the point of maximum plus error to the point of maximum minus error. Accordingly, to study the effect of eccentricity, angles of 180° should be measured at uniform intervals around the circle. This is exactly what is done in this test. It is only a matter of extracting the information from the data to study the effect of eccentricity. The following method is suggested as a quick, practical, and sufficiently accurate means of making this study.

It is evident that if a certain measurement of the 180° angle gives a result that is too small due to eccentricity, the measurement of the same angle with the opposite side of the circle will give a result that is too large by the same amount. Accordingly the re-

sults from opposite sides of the circle are paired. The errors of the second half are changed in sign. They should now agree with their opposites. The average of each pair is taken and the results are plotted. Then the signs are reversed and then plotted again to represent the remainder of the circle. (*See* Figure 3.)

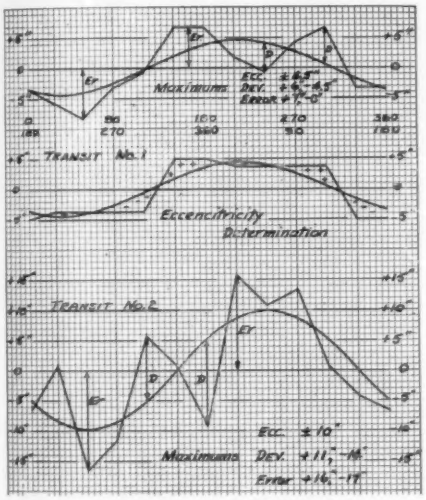

FIGURE 3.—The circle errors of two 30-second transits.

A sine curve is then fitted by eye to the results. This is not a difficult operation. Only one loop of the sine curve need be fitted and the remainder drawn from it. The requirements of a sine curve are that its intersections with the zero line be 180° apart, that it reach its maximum half way between, and that the quarter points be 7/10 of the height of the maximum.

The curve is sketched so that the plus and minus areas between it and the plotted errors are minimum and appear to balance. Once the since curve is plotted, the deviations from the sine curve can be measured. These can be assumed to be the errors caused by variations in the positioning of the graduations. Of course, as it is too long an operation to measure the error of each graduation, it must be assumed that this is a representative sample.

It is well to note that each error determined in any category is the error of measuring one angle caused by errors in the circle.

RESULTS

The upper graph in Figure 3 shows the results of plotting the errors of an American 30-second transit, which we will call Transit No. 1. This is a good circle.

Most of the errors are less than 5″ and the maximum errors (marked Er) are + 7″ and − 8″. Directly below this graph is shown the method of establishing the sine curve which represents the eccentricity. The line joining the plotted errors of the second half of the observations is identical to the line for the first half except that it is opposite in sine. The upper loop of the sine curve is 180° long and its height and position are chosen to make the plus errors appear equal to the minus errors and, in addition, to make errors as small as possible. The eccentricity is ± 5″.

The eccentricity curve is now transferred to the upper diagram. The deviations from the eccentricity curve to the error curve are assumed to be a representative sample of errors of measuring an angle due to improper positioning of graduations. In this case the maximum deviations (marked D) are + 6″ and − 4.5″.

Below are shown the plotted errors for another 30-second transit, Transis No. 2. This circle is less than half as accurate as the circle of Transit No. 1.

The maximum errors are + 16″ and − 17″, the eccentricity is ± 10″, and the maximum deviations are + 11″ and − 14″.

This transit should be returned to the manufacturer with a request that he install another circle. If the graph is also sent to him, he will be more inclined to do so!

It is very likely that the manufacturer will have no trouble in finding a better circle. Remember, no two circles are alike.

If the manufacturer cannot supply a better circle, it is the opinion of the speaker that it is cheaper to throw away the transit than to waste the time of the field party by forcing them to use it. Such a transit can be used economically only when it is used so little or for such approximate work that the extra

time it requires of the field party costs less than the price of a new instrument.

READING DEVICES

It must not be forgotten that devices for reading the circle can be serious sources of error. Verniers can contain errors and so can micrometer microscopes. Reading devices can also be checked quite easily and, in fact, they really should be checked before the circles are checked, so that the errors they introduce can be avoided when checking the circles. The following procedure is suggested. This method has its faults, but it gives results of sufficient accuracy to determine whether or not the instrument has serious faults, or which of two instruments is the better.

Procure and engine-divided scale with about fifty graduations per inch. A scale for fifty feet to the inch or the logarithm scale of an engine-divided, ten-inch, slide rule are both excellent. In the experience of your speaker, they need not be calibrated if made by a reputable manufacturer.

1. Set the scale at the height of the telescope and, if possible, at a proper distance so that the number of seconds represented by a division is a round number. At 103⅛ inches from the transit center, each division on the 50 scale will represent 40 seconds. At 102½ inches each division on the logarithm scale will represent 40 seconds. The scale should be placed horizontal and at right angles to the line of sight.

2. If a transit is being tested, set the vernier at zero and aim at an even division close to the point at which the line of sight makes a right angle with the scale. Then set the vernier successively at each two-minute mark and read the scale for each setting. Since it is quite easy to estimate a tenth part of each division on the scale, the values determined represent angles within ± 2″ of arc. The process should be repeated starting with 180° and the values averaged. This will eliminate errors due to the eccentricity of the circle.

When an optical-reading theodolite is being tested, it is easier to point at certain divisions on the scale and then to read the angular values with the micrometer.

Whichever method is used, the average values determined with the instrument are compared with the known angular values given by the scale to determine the corrections required. It is well to plot the resulting corrections on a graph. Corrections, of course, are equal to errors with their signs changed.

Let us take a look at the vernier corrections of Transit No. 1. (*See* Figure 4.)

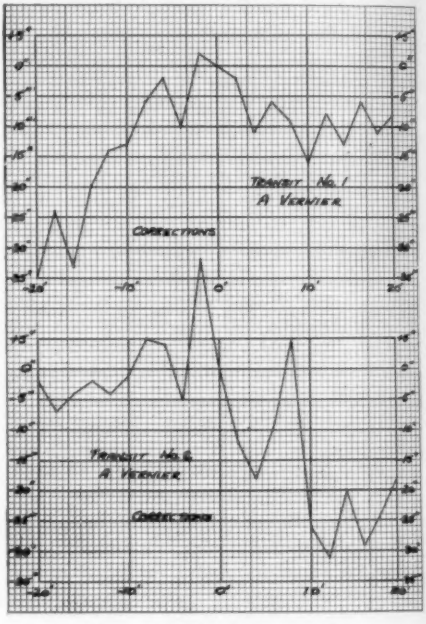

FIGURE 4.—Vernier corrections.

Practically all of the corrections are minus, which indicates that the vernier is too short. The average is about – 10″, for most of its length, but the counter-clockwise corrections are serious near the end of the counter-clockwise vernier. The maximum corrections on the two sides are – 16″ and – 35″. These corrections are so serious that they can easily be seen on the instrument by just looking at the vernier. When the end of one of the verniers is placed in coincidence, the other appears to be almost one minute short.

Please note the corrections required for

the A vernier on Transit No. 2. The range runs from + 18″ to – 31″. The peaks in this curve were checked several times. This is exactly what the verier reads.

These transits are not freaks. They were taken from the regular instructional equipment of the University.

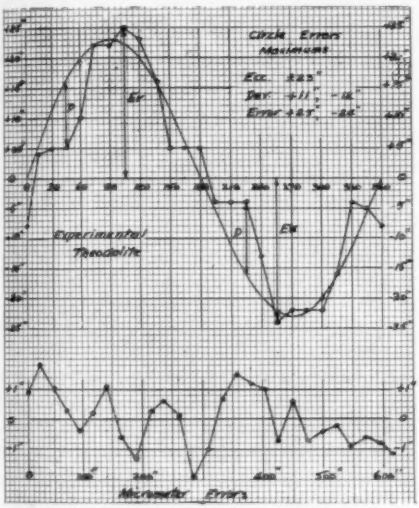

FIGURE 5.—Circle and micrometer errors of an experimental theodolite.

Figure 5 shows the results of a test on an experimental theodolite, so it is very unlikely that you would acquire one that would give results quite as serious as this, but then again you might.

This test was made a little more carefully that the tests outlined above, but exactly the same methods were used. Readings were taken at every 15°. Note that the eccentricity is ± 23, the maximum deviations are + 11″ and – 12″, and the maximum errors were + 25″ and – 24″.

However, the micrometer errors were very small. Please note that the scale of the graph had to be enlarged to show them. The run is about 2″ too long. This, of course, can be easily adjusted. Most of the errors were less than 1″, and the maximum errors were + 1.40″ and – 1.45″.

It seems to your speaker that, in this day of high man-hour costs, it is money in our pockets to test the circles and reading devices of our instruments. It seems obvious that the circles and their verniers or micrometer microscopes will never be made to give greater accuracy than is demanded by the engineers who use them.

We all fuss a lot about instrument adjustments but usually fail to make any examination of the parts of the instrument that really limit its accuracy—the circle and vernier.

THE DIFFICULTY OF MAKING CIRCLES

It is, of course, very difficult indeed to make good circles and good verniers. When a circle on an ordinary transit is correct to ± 5 seconds it is about as perfect as can be expected. Efforts have been made to improve circles, and better dividing engines are available. But let us follow the efforts of one manufacturer to make the best circles that can be made. Your speaker is familiar with this work as he served as a consultant to that firm—the Keuffel & Esser Company.

This company has available an SIP* dividing engine. This is, as you know, one of the finest dividing engines available. A dividing engine consists of a large, circular table which is rotated in a horizontal plane by a worm that engages a gear around its circumference. The worm is actuated by pawls that engage a ratchet. The movement of the pawls can be limited as desired. Around the circumference of the table is a cam that makes slight corrections in the movement of the worm to eliminate residual errors in the construction of the engine. The spindles of the tables are of various designs. The SIP engine owned by Keuffel & Esser has a ball-bearing spindle.

When the engine was first tested, it showed eccentricity, a very strange kind of eccentricity, because a complete cycle required two turns of the table instead of one turn. Since the balls in a ball bearing travel around the race at half speed, only the balls could take two turns of the table to complete a cycle. Accordingly, the conclusion was reached that the balls were not quite the same size. Despite the fact that it was

* Societe Genevoise d'Instruments Physique of Geneva, Switzerland.

known that the balls had been selected with great care. it was decided to send for another set.

At the time the balls were installed, the engine had to be dismantled in order to be moved into another building, so some time elapsed before an accuracy test could be made.

The test was accomplished by means of four micrometer microscopes supplied by the manufacturer. These were set 90° apart and readings were taken by four observers at each degree of rotation. At this point it should be said that accurate circle graduations are cut near the circumference of the table. With four microscopes it is possible to determine the actual angle of rotation of the circle or its eccentricity without relying on the accuracy of the graduations. The results of this test showed maximum plus error of 3.2 seconds, a maximum minus error of 1.4 seconds, and errors of plus or minus one second or more at several points around the circle. These were exclusive of the effects of eccentricity.

Following this test, the worm and the circumferential gear actuated by it were cleaned thoroughly. This reduced the maximum errors to + 1.3 seconds and – 1.2 seconds.

It must be remembered that these errors were errors of the dividing engine and not errors of a circle cut by it.

Since it was felt that these results were not satisfactory, the engine was very carefully examined. It was found that the follower on the correction cam was not exactly following the surface of the cam. This was corrected, and the worm and gear were again thoroughly cleaned. These changes reduced the errors until all fell within + 0.9 second and – 0.8 second. The method of reducing the data eliminated the effect of eccentricity in order to confine the possibilities of error as much as possible.

A separate test was made to determine eccentricity. The table was rotated 360° between readings. Since each ball in the spindle bearing will be moved only 180° during this operation, the maximum effect of any difference in the size of the balls would be found. Because the readings were always taken at the same line of graduation by each micrometer, no graduation error could enter into the result. This test indicated that the center of rotation of the table wandered within a circle of radius equivalent to 0.4 second measured at the outside of the table. This would be equivalent to plus or minus 2.9 seconds when measured at a circle 5½ inches in diameter, as the actual radius of the circle of error was 0.00004 inch.

Contrary to expectations, the movement of the center did not follow a constant pattern as would have been the case if the eccentricity were entirely due to variation in the size of the balls. Accordingly, it was thought that some of the errors were due to the races or to the lubricant. It was felt that this type of error could not very well be reduced.

Accordingly, a circle was cut on the dividing engine and tested. The tests were made on a circle-testing device equipped with four micrometers. The maximum errors of the average of the two halves of the circle were + 3.2 seconds and – 3.3 seconds. Further readings were taken at the points which showed the greatest errors on the dividing engine. These showed a maximum of + 2.9 seconds and – 3.5 seconds.

The circle was mounted in a theodolite and tested. The maximum errors were + 3.8 seconds and – 3.6 seconds.

Please note that after every possible correction had been made the best that could be achieved were errors of 3.8 and 3.6 seconds. This certainly demonstrates the difficulty of making circles.

But the story doesn't end here. Since a large percentage of these errors could be accounted for by the eccentricity of the dividing engine, the thinking kept returning to this particular difficulty. Discussions on this point have lead to a revolutionary idea. The results of this scheme are not yet proven by sufficient data for publication at this time, but after the dividing engine was corrected according to this idea one circle has been cut, mounted in a theodolite and tested.

When the data were collected, this proved to be the pay-off. The value of the average of the two halves of the circle showed maximum errors of + 0.5 second and – 0.4 sec-

ond. Perhaps a better 5½-inch circle exists today but it is difficult to believe.

Let us hope that future circles cut by the company prove that this particular circle was not an accident.

CONCLUSION

Gentlemen, it is obvious that accurate circles and accurate reading devices can be made. When they are available field costs will be reduced. However, it must be remembered that instrument manufacturers are in business to make money and every cent that can be cut from the cost of a manufacturing process will be cut.

Circles of less than high accuracy will pass inspection and continue to be handed on to users, because, in the opinion of the companies that manufacture instruments, the user prefers to save a few dollars in the first cost of the instrument rather than to save a great many dollars in field operations.

If we do not demand accurate circles, we will not get them. Unless we test our circles we cannot demand accuracy.

In concluding this paper, may the suggestion be made that you try out the rather simple tests here outlined, both on transits and on theodolites, and that, if the accuracy of these instruments does not satisfy you, you communicate with the manufacturer. It seems evident that those who follow this suggestion will get better instruments and, sooner or later, all of us will get better instruments.

The suggestion is a means of reducing field costs at a time when it is imperative to reduce costs. Let us try it. Thank you.

TABLE OF RESULTS—TRANSIT NO. 1 CIRCLE

Nominal Angle	Set No. 1 Angles, Omitting 180° Vern. A	Vern. B	Avg.	Set No. 2 Angles, Omitting 180° Vern. A	Vern. B	Avg.	Avg. Angles Sets 1 & 2
0°–180°	0″	+ 10″	+ 5″	− 10″	+ 10″	0″	+ 2.5″
30°–210°	− 10″	0″	− 5″	0″	+ 10″	+ 5″	0.0″
60°–240°	− 20″	− 10″	− 15″	0″	+ 20″	+ 10″	− 2.5″
90°–270°	− 20″	+ 20″	0″	0″	+ 10″	+ 5″	+ 2.5″
120°–300°	+ 10″	0″	+ 5″	0″	+ 10″	+ 5″	+ 5.0″
150°–330°	0″	+ 20″	+ 10″	+ 10″	+ 20″	+ 15″	+ 12.5″
180°–360°	+ 10″	+ 10″	+ 10″	+ 10″	+ 20″	+ 15″	+ 12.5″
210°– 30°	+ 10″	+ 10″	+ 10″	− 10″	+ 20″	+ 5″	+ 7.5″
240°– 60°	− 10″	+ 10″	0″	0″	+ 20″	+ 10″	+ 5.0″
270°– 90°	0″	+ 20″	+ 10″	0″	+ 20″	+ 10″	+ 10.0″
300°–120°	+ 10″	+ 10″	+ 10″	+ 10″	+ 20″	+ 15″	+ 12.5″
330°–150°	0″	+ 10″	+ 5″	− 10″	+ 10″	0″	+ 2.5″
						Sum =	+ 70.0″
Average represents the effect of the collimation error.						Avg. =	+ 5.8″

Errors Less Collimation Error Nom. Ang.	Circle Errors
0°–180°	− 3.3″
30°–210°	− 5.8″
60°–240°	− 8.3″
90°–270°	− 3.3″
120°–300°	− 0.8″
150°–330°	+ 6.7″
180°–360°	+ 6.7″
210°– 30°	+ 1.7″
240°– 60°	− 0.8″
270°– 90°	+ 4.2″
300°–120°	+ 6.7″
330°–150°	− 3.3″

Eccentricity Computation Average of Two Halves of Circle			
− 3.3″	− 6.7″	=	− 5.0″
− 5.8″	− 1.7″	=	− 3.8″
− 8.3″	+ 0.8″	=	− 3.8″
− 3.3″	− 4.2″	=	− 3.8″
− 0.8″	− 6.7″	=	− 3.8″
+ 6.7″	+ 3.3″	=	+ 5.0″
			+ 5.0″
			+ 3.8″
			+ 3.8″
			+ 3.8″
			+ 3.8″
			+ 5.0″

TABLE OF RESULTS—TRANSIT NO. 2 CIRCLE

Nominal Angle	Set No. 1 Angles, Omitting 180° Vern. A	Vern. B	Avg.	Set No. 2 Angles, Omitting 180° Vern. A	Vern. B	Avg.	Avg. Angles Sets 1 & 2
0°–180°	– 1′50″	– 1′40″	– 1′45″	– 2′10″	– 1′30″	– 1′50″	– 1′47.5″
30°–210°	– 1′40″	– 1′30″	– 1′35″	– 1′50″	– 1′40″	– 1′45″	– 1′40.0″
60°–240°	– 1′50″	– 2′00″	– 1′55″	– 2′00″	– 2′00″	– 2′00″	– 1′57.5″
90°–270°	– 1′40″	– 1′40″	– 1′40″	– 2′20″	– 1′50″	– 2′05″	– 1′52.5″
120°–300°	– 1′40″	– 2′00″	– 1′50″	– 1′20″	– 1′20″	– 1′20″	– 1′35.0″
150°–330°	– 1′30″	– 1′50″	– 1′40″	– 1′40″	– 1′40″	– 1′40″	– 1′40.0″
180°–360°	– 1′30″	– 2′00″	– 1′45″	– 1′40″	– 2′10″	– 1′55″	– 1′50.0″
210°– 30°	– 1′40″	– 1′40″	– 1′40″	– 1′30″	– 0′50″	– 1′10″	– 1′25.0″
240°– 60°	– 1′30″	– 1′30″	– 1′30″	– 1′30″	– 1′30″	– 1′30″	– 1′30.0″
270°– 90°	– 1′20″	– 1′30″	– 1′25″	– 1′10″	– 1′50″	– 1′30″	– 1′27.5″
300°–120°	– 1′50″	– 1′30″	– 1′40″	– 1′30″	– 1′50″	– 1′40″	– 1′40.0″
330°–150°	– 1′40″	– 1′50″	– 1′45 ′	– 1′40″	– 1′50″	– 1′45″	– 1′45.0″

Sum = – 20′10.0″

Average represents the effect of the collimation error. Avg. = – 1′40.8″

Errors Less Collimation Error Nom. Angle	Circle Errors
0°–180°	– 6.7″
30°–210°	+ 0.8″
60°–240°	– 16.7″
90°–270°	– 11.7″
120°–300°	+ 5.8″
150°–330°	+ 0.8″
180°–360°	– 9.2″
210°– 30°	+ 15.8″
240°– 60°	+ 10.8″
270°– 90°	+ 13.3″
300°–120°	+ 0.8″
330°–150°	– 4.2″

Eccentricity Computation Average of Two Halves of Circle			
– 6.7″	+ 9.2″	=	+ 1.2″
+ 0.8″	– 15.8″	=	– 7.5″
– 16.7″	– 10.8″	=	– 13.8″
– 11.7″	– 13.3″	=	– 12.5″
+ 5.8″	– 0.8″	=	+ 2.5″
+ 0.8″	+ 4.2″	=	+ 2.5″
			– 1.2″
			+ 7.5″
			+ 13.8″
			+ 12.5″
			– 2.5″
			– 2.5″

TRANSIT NO. 1—A VERNIER

Scale Readings Unit = 1/50 inch at 0°	at 180°	Sums/100 Avg. in Inches	Subtract 4 Dist. in Inches	Dist./115.25 Tangent of Angle	Measured Angle	Angle Set on Vernier	Corrections
167.6	167.3	3.349	– 0.651	0.005649	19′25″	20′	– 35″
170.7	170.3	3.410	– 0.590	5119	17′36″	18′	– 24″
174.3	173.9	3.482	– 0.518	4495	15′27″	16′	– 33″
177.4	176.8	3.542	– 0.458	3974	13′40″	14′	– 20″
180.7	180.4	3.611	– 0.389	3375	11′36″	12′	– 14″
183.8	183.4	3.672	– 0.328	2846	9′47″	10′	– 13″
186.8	186.7	3.735	– 0.265	2299	7′54″	8′	– 6″
190.1	189.9	3.800	– 0.200	1735	5′58″	6′	– 2″
193.3	193.3	3.866	– 0.134	1163	3′50″	4′	– 10″
196.8	196.4	3.932	– 0.068	0590	2′02″	2′	+ 2″
200.0	200.0	4.000	– 0.000	0000	0″	0′	
203.5	203.1	4.066	+ 0.066	0.000573	1′58″	2′	– 2″
206.6	206.2	4.128	+ 0.128	1111	3′49″	4′	– 11″
210.0	209.8	4.198	+ 0.198	1718	5′54″	6′	– 6″
213.3	213.0	4.263	+ 0.263	2282	7′51″	8′	– 9″
216.3	216.3	4.326	+ 0.326	2829	9′44″	10′	– 16″

220.0	219.8	4.398	+0.398	3453	11′53″	12′	− 7″
223.1	223.1	4.462	+0.462	4009	13′47″	14′	−13″
226.9	226.4	4.533	+0.533	4625	15′54″	16′	− 6″
230.0	229.7	4.597	+0.597	5180	17′49″	18′	−11″
233.4	233.2	4.666	+0.666	5779	19′51″	20′	− 9″

TRANSIT NO. 2—A VERNIER

Scale Unit = 1/50 inch Readings at 0°	at 180°	Sums/100 Avg. in Inches	Subtract 4 Dist. in Inches	Dist./115.25 Tangent of Angle	Measured Angle	Angle Set on Vernier	Corrections
167.0	167.2	3.342	−0.658	0.005810	19′58″	20′	− 2″
170.5	170.6	3.411	−0.589	5201	17′52″	18′	− 7″
174.0	173.5	3.475	−0.525	4636	15′56″	16′	− 4″
176.9	177.1	3.540	−0.460	4062	13′58″	14′	− 2″
180.3	180.4	3.607	−0.393	3470	11′56″	12′	− 4″
183.7	183.4	3.671	−0.329	2905	9′59″	10′	− 1″
186.8	186.6	3.734	−.0266	2349	8′05″	8′	+ 5″
190.0	190.0	3.800	−0.200	1766	6′04″	6′	+ 4″
193.8	193.3	3.871	−0.129	1139	3′55″	4′	− 5″
196.0	196.4	3.924	−0.076	0671	2′18″	2′	+18″
200.0	200.0	4.000	0.000	0000	0″	0′	
202.7	203.2	4.059	+0.059	0.000521	1′48″	2′	−12″
206.1	206.1	4.122	+0.122	1077	3′42″	4′	−18″
209.6	209.7	4.193	+0.193	1704	5′52″	6′	− 8″
212.8	213.8	4.266	+0.266	2349	8′05″	8′	+ 5″
215.5	216.0	4.315	+0.315	2781	9′34″	10′	−26″
218.6	219.2	4.378	+0.378	3338	11′29″	12′	−31″
222.4	222.6	4.450	+0.450	3974	13′40″	14′	−20″
225.3	225.8	4.511	+0.511	4512	15′31″	16′	−29″
229.0	229.0	4.580	+0.580	5121	17′36″	18′	−24″
232.3	232.6	4.649	+0.649	5731	19′42″	20′	−18″

New Series of Aeronautical Charts

A new series of aeronautical charts designed to facilitate flight planning and flight operations for pilots operating the new intermediate airway system, which became effective April 6, 1961, has been announced by the Coast and Geodetic Survey and the Federal Aviation Agency.

The new charts, prepared by the Coast and Geodetic Survey in accordance with specifications of the Federal Aviation Agency, satisfy both civil and military requirements. Previous en route charts were designed primarily for civil use.

While the new charts depict information pertinent only to en route, instrument navigation at altitudes from 14,000 to 24,000 feet, they include provision for showing a low-altitude "sheet-line layout" for pilots transitioning to altitudes below 14,000 feet.

The charts are printed back-to-back on four sheets, 20 by 45 inches. When folded they form eight 5- by 10-inch panels of chart data and one panel of tabulated information. The sheets may also be assembled as a wall chart for preflight planning.

Seven charts cover the United States, excluding Alaska and Hawaii, at a scale of 1 inch equals 28 nautical miles. An eighth chart, developed at the scale of 1 inch equals 20 nautical miles, covers the New York-Chicago-Washington triangle.

Chart information includes portrayal of intermediate-altitude airways; position, identification, and frequencies of radio aids; selected airports; distances; reporting points; VOR changeover points; restricted areas (limited to those whose vertical limits extend into the intermediate structure); and other related data.

The new charts are simple and functional in design and format. The fold of the charts is improved, making them more compact and easy for the pilot or navigator to use in close quarters. Information concerning facilities pertinent to an airway is shown adjacent to the symbols on the line of the airway.

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1934

Subdivision Calculation by Electronic Computation

By HOWARD JACOBY

JACOBY & ASSOCIATES, INC., HICKSVILLE, NEW YORK

SINCE electronic digital computers became generally available for engineering calculations in 1956, one of the most cost- and time-saving applications has been in curvilinear subdivision calculation. The purpose of this paper is to review the experience to date with a view toward pointing out both the advantages and problems of electronic computation to aid designers already employing the tool as well as those who haven't done so yet.

Because the vast majority of subdivision design firms are not large enough to justify acquisition of even a "small" electronic computer (whose purchase prices start at $50,000 or so), specialist computer service firms such as the author's have been employed for the most part. The latter firms generally comprise professional engineers who have backgrounds in both engineering design and electronic computation.

HOW COMPUTERS SOLVE SUBDIVISIONS

A number of different makes and models of computers are employed in subdivision work. Each has to have a "program", or set of instructions, prepared for it to handle the calculations. These differ in detail, depending upon the particular firm's equipment and their calculation philosophy. But all the computer programs employ the same general approach.

The economics of computer operation demand that the calculations be continuous, i.e., that solutions be stored within the computer for use in subsequent calculations, permitting calculation of entire blocks and subdivisions in one "pass" through the computer. Thus, the general approach employed by all computer service firms in the author's knowledge is to start with a closed parcel and build lot upon previously solved lot until all lots close perfectly and fit perfectly within the perimeter traverse. In short, this is identical to the approach of manual calculation.

The basic difference is that manual calculation permits greater flexibility since the human computer sees the results of one lot before proceeding to the next. However, the economics of electronic computer operation are such that one or more reruns of a block can be accomplished faster and at less cost than the more flexible "one-pass" human calculation.

Before exploring this question further, we should see just how the computer goes about solving for sides. The procedure is basically that of manual calculation, modified by the abilities of the electronic computer. Two specific approaches are employed in the programs of computer service firms. In one, lengths and bearings (in the form of azimuth in radians) are stored in the computer; in the other, coordinates are stored. Both approaches require the calculation of departures and latitudes from sine and cosine values, the arc-tangent solution, and the solution of sine and other triangles.

The computers employed for subdivision work can store between 2,000 and 4,000 ten-digit "words", or numbers. It is an obvious impossibility to store the sine table. Computers therefore are programmed to develop the sine and cosine of an angle by one of a number of approximation formulas. These can be set up to any desired accuracy. For example, sines and cosines are generally developed to ± 4 in the ninth place. Similarly, arc-tangent and arc-sine "routines" that have commensurate accuracy are used.

The basic procedure then is for the computer to develop the sine and cosine, multiply to obtain departure and latitude, sum up the departures and latitudes of all sides in a solution, obtain the arc-tangent result (the final solution for unknown length and bear-

ing of the same side) and, if necessary, solve a triangle for the other types of traverse solution: (A) two unknown lengths, (B) unknown length of one side and unknown bearing of another, or (C) two unknown bearings. Case B may involve two possible solutions while case C always does. The computers are set up so that the person preparing the input data sheets can indicate to the computer which solution the computer should retain.

This, then, is the generalized procedure for solving a traverse (either open-end or closed). Areas are usually obtained by the DMD method. With computer programs storing lengths and bearings, areas are generally calculated automatically, since closed traverses have to be solved. Programs storing coordinates need to solve unknowns between starting and ending coordinates, so the obtaining of area is optional. When area is required, obviously a closed traverse must be solved.

The basic reason for the use of an electronic computer in subdivision calculation is the widespread design of curvilinear subdivisions. An integral part of the calculation of a lot is the calculation of the curve data. It is in this phase that computer service firms differ widely in specific approach.

As an example, one procedure is first to solve triangular traverses to obtain the length and bearing of the chord; then solve the lot itself with area shown to the chord. If the client desires, complete curve data (arc length, delta angle, tangent, area of sector, and area of segment) can be printed out right after the lot calculation. Area of segment is added or subtracted to the lot area (which is to the chord) to produce lot area to the curve. Other procedures end up with the same or similar results arrived at by different means, some involving separate processing of curve data.

To perform subdivision calculations by electronic computation, service firms generally require a preliminary layout, a perimeter traverse, minimum frontage and area requirements, if applicable, and other instructions as to results required (i.e., complete curve data, coordinates, etc.).

In subdivision calculation by electronic computer, it is imperative that the preliminary layout be drawn accurately to scale. This is so because the person preparing input data for the computer must be able to determine from the drawing in which lot the PC and PT of a curve will fall, where radial side lines will intersect, etc. Here then is another difference between hand and computer calculation, wherein an accurate drawing is not essential for the former (although it is highly desirable and perhaps even essential where tight area requirements are involved).

If a preliminary "sketch" is submitted, some service firms will redraw it to good scale so they can proceed with the computations. Other service firms require the designer to prepare an accurately scaled drawing. It does seem more logical for the designer to do this in any event, because usually design decisions are necessary which are better made by the designer.

Perhaps the widest divergence of practice among computer service firms is in the format of results returned to clients. It should be emphasized, however, that the results of *all* the reliable, service organizations are quite correct.

One approach is to furnish the direct computer print-out of centerline, lot, and curve calculations accompanied by the layout submitted by the designer, on which side-identification numbers tie to the computer print-out. The designer must transpose the results onto his final working drawing (which can also be furnished, bare of numbers, by an automatic line-plotter that can plot at any desired scale). For this transposition, the designer's draftsman need be concerned only with those traverses corresponding to lots. But the designer is advised to read through the entire print-out, because, by noting the input data of each traverse and following the logic, or pattern, through each block, he can satisfy himself as to just how the computations were performed. If he does this, it is almost as if the calculations never left his office.

Another approach is to furnish the accurately drawn preliminary layout, with

lengths and bearings noted thereon, accompanied by a partial print-out showing only coordinates and curve data. Although this method simplifies the designer's task in transposition, it does not permit checking of the results without actual spot calculation.

ADVANTAGES OF ELECTRONIC COMPUTATION

Advantages of subdivision calculation by electronic computer are numerous. Experience has shown that most designers try their first job because of a tight time deadline. Most service firms normally provide results for even 300- and 400-lot subdivisions within two or three weeks and can cut this to less than a week by priority handling. Incidentally, the computer running time is measured in hours; the bulk of the time is required for analyzing the subdivision for an appropriate pattern of solution and setting up input data for the computer.

After studying the results of the first project, most designers then realize the advantages of accuracy and cost saving of computer solution. Cost is an especially interesting subject. By and large, hand calculation cost far exceeds computer cost for the same amount of calculation. However, some designers do not require everything that the computer produces as a matter of course. Area is a case in point. Hand computation by DMD probably runs about half again as much as the basic lot calculation, but the electronic computer turns it out for about one-tenth cost.

Another advantage of electronic computation is the facility and low cost with which changes can be made. The biggest item of cost for a computer service firm is in setting up correct input data for the computer to produce results that are mathematically perfect. Once this is done, a change, although involving a complete rerun of a block, requires only the changing of three or four pieces of input data. Service firms generally charge around 50 to 75 cents a lot for reruns requested by the client.

PROBLEMS STILL EXIST

Though the advantages far outweigh the problems, there are still a number of difficulties connected with electronic computation. Many of these, however, can be overcome by designers being aware of them.

The question of tight areas is a two-sided one. Take a 20-lot block, with all frontages curved, a 10,000 sq. ft. minimum, and about 2,000 sq. ft. leeway in the whole block. Such a block might require two or three reruns by electronic computer for all lots to meet area requirements, especially if radial side lines were required and frontages were a critical factor. On the other hand, it might be that a second time through on hand calculation would be necessary. The best advice that can be offered to designers, in cases of this kind, is to get a quotation from a computer service firm and compare it to hand calculation cost.

Especially, with designers employing electronic computation for the first time, incomplete instructions to the service firm are sometimes a problem. Design firms often have their own special methods of treating various situations. Computer service firms can accommodate these if they are aware of them.

Along the same line, designers may take very basic items for granted, but they should realize that computer service firms are operating over a wide geographical area. For example, the author's firm once received a preliminary layout with all the detailed information specified such as area, return radii, curve data, and frontage minimums. But the designer forgot to mention that he wanted all lots calculated to the street centerlines rather than the street right-of-way lines.

One of the most perplexing problems involves subdivisions which contain previously recorded parcels. In some cases, there is a slight error of closure on these parcels due to the lengths being given to 0.01 ft. instead of 0.001 ft. This error can throw coordinates off by as much as 0.02 ft. A more serious situation develops when the recorded dimensions are definitely in error. Designers should specify what to do with such errors, particularly when coordinates are involved.

Interesting situations also develop in the

Lot No.	Side No.	Bearing	Length	Departure	Latitude	Sine of Brg	Cosine of Brg.
1	1	N 88 54 20 W	177.997	177.964 -	3.399	.999817568	.019100490
	2	N 01 05 40 E U			.000	.019100490	.999817568
	3	S 87 41 25 E U			.000 -	.999187571	.040301330
	4	S 02 18 35 W	70.000	2.821 -	69.943 -	.040301330	.999187571
ANS	2	N 01 05 40 E	73.792	1.409	73.778	.019100490	.999817568
ANS	3	S 87 41 25 E	179.522	179.376	7.234 -	.999187571	.040301330
AREA				12850.623 sq ft	.295 acres		
2	3	N 87 41 25 W	179.522	179.376 -	7.234	.999187571	.040301330
	5	N 01 05 40 E U			.000	.019100490	.999817568
	6	S 87 41 25 E U			.000 -	.999187571	.040301330
	7	S 02 18 35 W	65.000	2.619 -	64.947 -	.040301330	.999187571
ANS	5	N 01 05 40 E	65.015	1.241	65.002	.019100490	.999817568
ANS	6	S 87 41 25 E	180.901	180.753	7.290 -	.999187571	.040301330
AREA				11713.742	.269		
3	6	N 87 41 25 W	180.901	180.753 -	7.290	.999187571	.040301330
	8	N 01 05 40 E U			.000	.019100490	.999817568
	9	S 87 41 25 E U			.000 -	.999187571	.040301330
	7	S 02 18 35 W	65.000	2.619 -	64.947 -	.040301330	.999187571
ANS	8	N 01 05 40 E	65.015	1.241	65.002	.019100490	.999817568

Typical print-out from calculations by IBM 650 electronic digital computer. "U" indicates unknowns--for Lot 1, the lengths of sides 2 and 3. When coordinates are desired, they are printed in place of departures and latitudes.

checking of previously calculated subdivisions. It is felt that simple checking of each lot for error of closure makes little sense. First, this process still costs about two-thirds of original calculation by electronic computation. Second, if errors are found the designer has to start all over. It makes more sense to recalculate the subdivision in the same pattern that was used originally in solving the subdivision. Thus, if the original calculations were correct, the two sets of results would agree. If they were not, then at least the electronic computer results would constitute correct and usable data.

However, it would be even more logical for the calculations to be made originally by electronic computation. The only difference in cost between original calculation and recalculation by electronic computation is in the time required to analyze the subdivision and choose starting data for the former. This generally doesn't amount to more than 30 percent of the cost.

In summary, it is hoped the foregoing has given the reader some insight into the techniques, advantages, and problems associated with calculation of subdivisions by electronic computation. It is believed the experience over the last four years has proved its reliability and economic feasibility many times over.

ASCE Active in Upgrading Surveying and Mapping*

The Committee on Professional Practice, the Surveying and Mapping Division and Executive Secretary William H. Wisely of ASCE are actively pushing the upgrading of Surveying and Mapping to full professional status.

Late in February Mr. Wisely, with Earle J. Fennell, F. ASCE, a member of the Executive Committee of the Surveying and Mapping Division, and A. O. Quinn, F. ASCE, representing the Asociation of Professional Photogrammetrists, held conferences in Washington with top personnel of the Corps of Engineers and of the Bureau of Reclamation. These conferences with the chief government users of surveying and mapping services were very productive in achieving a better understanding of the problem. For many years most such contracts have been let on a competitive basis, and considerable readjustment is proving necessary in widely scattered field offices.

In conferences with the government agencies a great need for impartial and authoritative curves or schedules of prevailing fees in field surveying and in photogrammetry was apparent. A pamphlet that would serve the purpose of Manual of Practice No. 38 but pertaining specifically to the surveying and mapping field would be very useful.

At a recent meeting of the Committee on Professional Conduct it was concluded that specialists in the field would have to provide guidance for clients in knowing when to negotiate and when it would be permissible to use competitive bidding methods. The Committee on Professional Conduct recommended that the Task Subcommittee on Professional Practice in Surveying and Mapping be reactivated in the Committee on Professional Practice to provide such guidance. Mr. Wiesly urged that the Division instruct its representatives in the subcommittee to apply themselves immediately to the production of a manual which would include prevailing fee data and guidance as to the delineation between professional and non-professional services.

Letters have been sent by ASCE to all known users of contract surveying, mapping and photogrammetric services urging negotiation for all work involving engineering judgement. These include highway and public works agencies; the Corps of Engineers, U. S. Army; the Department of the Interior; and others. Response has been favorable from federal and state agencies despite the serious problems of transition from competitive bidding to negotiation.

As requests for bids where price appears to be a factor come to the attention of ASCE, Executive Secretary Wisely writes a letter to the contracting agency urging that they change to negotiation procedures. More than thirty such letters have gone out in the past few months. Most reputable firms in this field are refusing to bid competitively, which is a real factor in the success of the drive to upgrade the profession.

* Copyrighted in 1961 by the American Society of Civil Engineers and originally published in *Civil Engineering*, April 1961, Vol. 31, No. 4, page 42.

Mountain-Climbing Motor Scooters

By JAMES E. CHAMBERLAIN

TOPOGRAPHIC DIVISION, U. S. GEOLOGICAL SURVEY

THE GEOLOGICAL SURVEY has been experimenting recently with specially-designed, mountain-climbing, motor scooters for transporting field parties and equipment in rugged, mountainous terrain. First reports indicate that scooters have advantages over both the ¼-ton jeep and that older friend of the topographer—the horse.

Initially, two scooters were purchased for testing by the Survey's Rocky Mountain Area. First reports were so encouraging that four more have since been purchased. The scooters are currently in use in New Mexico and field reports continue to be favorable. These scooters are powered by 5¾-horsepower, gasoline engines and have two forward speeds. Power is transmitted to the rear wheel by means of a centrifugal clutch and chain drive. The framework is a rugged, tubular-steel construction with special brackets added for holding surveying equipment. (*See* Figure 1.)

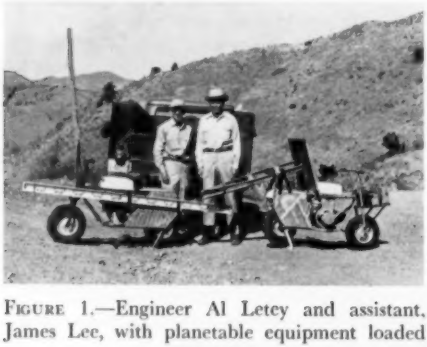


FIGURE 1.—Engineer Al Letey and assistant, James Lee, with planetable equipment loaded on scooters.

Top speed in low gear is reported to be about the same as a fast walk, but in high gear a speed of eight miles an hour is possible. A conversion kit has recently been made available to adapt this mountain-climbing scooter for normal use so that it may be used on the highway. As yet, the Survey has not tried the vehicles on highways, although this is planned. Two scooters may be transported in a pickup truck and unloaded easily by two men using a 2- × 6-inch or 2- × 8-inch ramp. (*See* Figure 2.)

FIGURE 2.—At end of truck travel, engineer and assistant unload scooters.

Field engineers report that there is quite a trick to learning to ride cross-country. The rider must lean forward at all times to ensure sufficient weight on the front wheel. After some practice, however, grades of up to 30 percent can be negotiated. (*See* Figure 3.)

Fuel consumption is approximately 1½ gallons for a day of normal activity. In rugged, remote areas of the Rocky Mountains, fieldmen carry extra fuel when doing considerable climbing.

FIGURE 3.—Planetable field party traveling cross-country up steep mountainside.

The World's Biggest Charting Job

By CAPTAIN HENRY G. MUNSEN, USN

HYDROGRAPHER, U. S. NAVY HYDROGRAPHIC OFFICE

ONE of the first things most of us learned at school, long ago when we were too young to trouble ourselves with mapping programs and national problems, was that three-fourths of the surface of our world was covered by water. Next we learned the names of the seven seas. After that, we spent the rest of the time in our geography courses learning about the remaining one-fourth of the world that man inhabits. We had learned all about the oceans.

Actually, of course, the oceans of the world have always been vast and unknown areas. Man's knowledge of them has grown but little in the thousands of years he has sailed upon them. Now that we are making rockets and satellites to explore the moon and planets of our solar system as well as the space beyond, we already know more of the moon's features than those of the sea bottom. Our world of water is, however, becoming of increasing importance. Among recent public statements on their significance was that by Representative J. C. Oliver of Maine, who said, "we might conclude that the entire scientific battle is to be waged in outer space, but many feel that the nation first unlocking the secrets of the ocean depths holds the key to future survival."[1] A similar concern was expressed last year by the Congressional Committee on Oceanography when it stated there is no comparison between the urgencies of the problems of the oceans and those of outer space.

We of the Hydrographic Office work daily with the urgent problems of the oceans, attacking the military aspects of concern to the Fleet, and working in support of the merchant navigator. We are continually searching for ways of finding and making use of the ocean's secrets, but they are well kept, challenging our resources and utmost ingenuity. This is true of those phenomena that are the concern of oceanographers just as it is true of those that concern hydrographers, whose job it is to survey and chart all information needed for navigation.

SIZE OF THE TASK

Our central and traditional concern at the U. S. Navy Hydrographic Office has been to provide information essential for safety of marine navigation. To do this, the Hydrographic Office publishes about 6,000 nautical charts plus some 300 charts intended for special operations. From 40 to 60 entirely new charts are published yearly, together with about twice as many new editions of existing charts, all incorporating the results of new hydrographic and photogrammetric survey information. Such charting requires a significant effort in terms of the ships, aircraft, base plant, and manpower required to execute the surveys and utilize their results. Currently, the Hydrographic Office exercises technical control over thirteen surface ships, two survey submarines for special oceanographic investigations, and two specially configured aircraft which are employed on a worldwide magnetic survey. Additionally, we place observers on our icebreakers in the Arctic and Antarctic regions and collaborate in the manning of certain ships of the Canadian Navy concerned with Arctic resupply operations. Finally, we receive a great volume of bathymetric information from the vessels of the U. S. Navy. This last constitutes a somewhat primitive form of surveying the great open ocean areas and is, in fact, our principal source of information in these regions, inasmuch as no formal surveys in the oceanic regions remote from coast lines have ever been conducted.

The stated survey requirements which have

Presented at the 20th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 21–23, 1960.

[1] Oliver, J. C., *Congressional Record*, 5 Oct. 1959, Vol. 105, No. 169, p. 8666.

been given to the Hydrographic Office to prosecute would take until approximately the year 2000 to complete, provided that the present survey fleet holds together and that no new requirements were given to us. As of that date we would hardly expect to cover much more than about one percent more of the oceans, and these regions would in actuality be near shore or coast areas.

ECONOMIC-STRATEGIC REQUIREMENT

What is the economic and strategic importance of this charting job? Our country's economy is of course affected by the goods and materials we import and export, and we become all too uncomfortably aware in wartime of our dependence on the strategic materials we must import.

The active American merchant fleet consists of slightly less than 1000 ocean-going vessels which are dependent upon the U. S. Navy Hydrographic Office for safe charting. Each of these vessels would cost a minimum of 10 million dollars to replace. The total amount that the Hydrographic Office spends on classic nautical charting and related publications is slightly over 2½ million dollars a year. If through the use of our products the stranding and loss of one American ship per year is prevented, and parenthetically I am sure that our batting average is much higher than this, then the American tax payer has his money back multipiied by four. It is interesting to note that the dollar value of our products sold to the American merchant mariner, with a small but indefinable percentage being purchased by foreign ship owners, is approximately 330,000 dollars a year. Our charting is indeed a cheap form of insurance for the mariner.

Because ships provide the most economical means of transporting large cargoes, maritime countries must see that their harbors and coasts are accurately surveyed and charted. Fortunately in the United States, the Coast and Geodetic Survey and the Army Corps of Engineers provide excellent charts of the coasts and navigable rivers of the continental United States and its possessions. There are, however, many less fortunate countries that have either no nautical charting services at all or are so meagerly supplied that their charts are frequently inadequate for safe navigation. In such cases, the Hydrographic Office, with the permission and cooperation of the country involved, may conduct the necessary hydrographic and photogrammetric surveys to fulfill its mission of supplying worldwide chart coverage for the U. S. Fleet and merchant marine.

About two years ago, aware of our responsibilities to the U. S. Merchant Marine, we sent letters to the presidents of the fifty leading American ship operators soliciting their frank comments on our chart coverage and requesting recommendations as to areas and ports which required improved chart coverage. The response to this was widespread and most gratifying. A great number of very valuable suggestions came in and I am happy to say that essentially all of them have been incorporated into our chart construction plans or have already been accomplished as a result.

SURVEY PROBLEMS

Despite our best efforts to cope with the task of world charting, the resources of the United States Navy are spread thinly compared with the magnitude of the surveying and charting job we face. The problem is, first of all, a matter of putting enough ships to work. The National Academy of Sciences Committee on Oceanography has made an estimate of the number of ships needed to survey the ocean areas of most interest to the United States within 10 years. The task would require some 30 ships, or 300 ship-years, at a cost of 300 million dollars. If we add surveys of inadequately charted coastal areas, excluding the Canadian and Greenland Arctic and the shores of Soviet bloc nations, we face a requirement of about 380 additional ship-years. When the approaches to the ports of minor islands important to the United States commerce are included, another 20 ship-years must be added. The total job thus adds up to about 700 ship-years.

While these figures are staggering enough from any point of view, they are only a part

of the picture. To fill the missing parts, we must also consider personnel shortages, ship positioning problems, and the limitations of present sounding equipment.

MANPOWER SHORTAGES

Regardless of the money, equipment, and ships available, no charting problem can be accomplished without enough adequately trained personnel—both aboard the ships and in the office. At present, only about 5 percent of our total personnel strength of 1,500 is engaged in field operations. However, the work turned in from even these 70 or 80 hydrographers in the field, added to the chart information acquired from other nations, generates a volume of compilation and revision work in the office that is chronically beyond the capability of our limited cartographic staff.

Budget and personnel ceilings are always part of the problems, but even if we had no such money problems, we would still have a difficult time acquiring all the trained personnel needed. Checking the Russian effort, as it is popular to do these days, we find that the USSR established back in 1953 an institute known as the Higher Naval Hydrographic School. Its five year course in hydrography, geology, topography, aerial photography, and navigation equipment was designed to graduate 500 officers with the rank of lieutenant engineer each year.[2] While we do not advocate matching the USSR in this training effort, and even they have since curtailed the program, this emphasis that the Soviets have placed upon hydrographic charting is cause for reflection. We do need more professionally trained men. Beyond our manpower difficulties we of course have technological problems such as positioning of survey ships and determining the ocean depths. Though these problems accentuate those in the personnel area, they are important in their own right and require vigorous research and development effort.

Our equipment problems were much less severe a generation ago when we were not blessed with the technological advances that now make us want the latest electronic marvels at our beck and call, an example perhaps of Parkinson's second law at work.

HYDROGRAPHIC SURVEYING

In days past, and even now when surveying in sight of shore, sextant fixes were used with the three-arm protractor to plot a survey ship's position. The three-arm protractor, invented in 1800 by Captain Huddart, a British mariner, makes possible a mechanical solution of the "three-point" resection problem. When darkness or distance made the shore signals disappear we used to shut up shop. Now, however, we switch on electronic positioning systems and position the survey ship at all hours and in all weathers. Such positioning systems, whether they be of the distance-measuring or hyperbolic type, are accurate enough out to one hundred and sometimes two hundred miles at sea, but the longer-range systems such as Loran have not had the accuracy for precise hydrographic surveying. In the past this limitation has not troubled us, because exact surveys are not required for mid-ocean navigation. Nowadays, however, we are becoming concerned with knowing the shape of the ocean floor because of its significance in such matters as military operation, modern navigation, resource exploitation, and increase of scientific knowledge.

In addition to the difficulties of positioning our survey ships, we are faced with unfortunate limitations in our sounding equipment. Echo sounding is far faster and better than sounding with the lead line, but to accomplish our 700 ship-years of basic ocean and coastal coverage in any reasonable period of time, further improvement is needed.

Present sonic sounding instruments show in graphic form a profile of the ocean bottom along the course of a survey ship. This profile is really an average of the depth "illuminated" by sonic pulses from the transducer or projector in the ship's hull. If the sound beam has a 60° cone, for example, and the bottom is a mile beneath the ship, the area of the bottom covered by the cone of sound has a diameter of a little over a mile. In an area where the bottom is relatively flat, the depth shown by the profile is fairly

[2] Kennedy, R., "Hydrography for the Soviet Navy," *Bulletin, Institute for the Study of the USSR,* December 1958, pp. 10 and 11.

true, but in areas where the bottom is rugged and its slope changing rapidly, the plotted depth represents only an average picture of the bottom features. The problem may be compared to that of attempting to make a topographic map when the only information available to you is from widely-spaced, generalized profiles, perhaps recorded by a barometer that behaves most erratically in hilly country where you are most interested in accurate details.

COASTAL CONTROL AND TOPOGRAPHY

Although the hydrographic surveyor has headaches enough producing charts of deep ocean waters, he is of course heir to all the troubles of ordinary surveyors and geodesists when he is working along the coasts. For all ships, surface or subsurface, travel in or through coastal waters, and they require surveys and charts of coasts and ports. That these troubles of coastal charting are nothing new is indicated by an arresting article we recently came across in our archives. The statement was written in 1873 by British Staff-Commander Thomas A. Hull who left us this account regarding the equipping of a boat for hydrographic surveying: "Cushions and all dandy gear should be left on board the ship, as they will only be found in the way. The men should be in clean working dress, with blanket frocks in the tropics, and trained to be handy in taking off their shoes, not to be afraid of wetting their feet if necessary in landing or embarking, the Officer setting the example, being as ready to risk his comfort in surveying as he would be in shooting."[3]

The work of the hydrographic surveyor has of course changed in the past 80 years, but wet feet are still far from a rarity. Although aerial photography and precise photogrammetric instruments have relieved the surveyor of much tedious field work, the photographs alone can not be used to make a chart or map. We still have to struggle on the ground to put in networks of primary and secondary triangulation. Here, the helicopter, Figure 1, and electronic surveying equipments have helped to keep our feet dry and have made it possible to chart a much greater area during a survey season than previously possible. Nevertheless, geodetic control points, shorelines, and other significant features must be identified and annotated on the aerial photography; place names must be obtained and verified; and ground photos taken of aids to navigation.

Boats today, as in earlier times, must be guided through rocks and surf to put men and equipment on the beach, and neither the helicopter nor the amphibious tractor have entirely displaced the whaleboat. Modern techniques have greatly increased survey efficiency, but the hydrographic engineer jumping from a boat into a half-fathom of water with part of his gear strapped to his back and the rest in his hands must sometimes pause to wonder about his profession.

UNCOORDINATED DATUM PROBLEMS

So far we have discussed only problems occurring in surveys of localized areas. However, as every cartographer and geodesist realizes, one of the more important tasks before us today is obtaining information needed to relate the various datums of the world. The Hydrographic Office's main contribution in this respect is the collection and analysis of gravity data obtained by ocean gravity surveys. These surveys are generally conducted by submarines, which provide a stable platform for a gravimeter beneath the sea surface. Techniques are being developed for use of gravimeters aboard surface ships, and it even appears possible that we shall be able to make observations with airborne gravimeters. As observations are completed across wide ocean areas, better information on the size and shape of the earth, as well as on continental-datum relationships, can be developed. Meanwhile, from more limited local gravity surveys, we are able to correct astronomic positions of mid-ocean islands, eliminating "deflection of the vertical" effects, to derive better positions for them.

Normally, we are not concerned to correct an island's position this way. A ship approaching an island locates itself from

[3] Hull, T. A., "Practical Nautical Surveying," (A lecture delivered at the Royal United Service Institution) J. D. Potter, London, 1873, p. 13.

FIGURE 1.—Hydrographic Office engineer being lowered from a helicopter near a signalized survey station. The helicopter and electronic surveying equipment have made it possible to chart a much greater area during a survey season than was previously possible.

sextant fixes that have the same deflectional error found on the island, for the horizon plane about the ship is warped according to the direction of gravity. From the ship's view, it might even be undesirable to correct astronomic positions of islands. However, when we put the transmitters for a Loran chain on oceanic islands, we must relate the islands to each other and to the mainland as exactly as possible, and the uncorrected astronomic positions are no longer good enough. We must apply gravitational deflection corrections. Information from eclipse and occultation observations can also provide interisland relationships, as can the more expensive, airborne, line-crossing technique using Hiran. Currently, we are awaiting with interest the results of planned attempts to locate remote island by photographing very high altitude rocket flares against a star background.

CHART MAINTENANCE

Beyond the difficulties of relating the various datums of the world, and in addition to the problems of survey-ship positioning, personnel shortages, and sounding limitations, the Hydrographic Office has to cope with a very real chart maintenance problem. If it can be said that a map, like today's newspaper is out of date as soon as it is printed, how much more does this apply to nautical charts. Natural and cultural changes constantly occur along the coasts of the world. The characteristics and locations of buoys, beacons, and even lighthouses are constantly being changed in all areas of the world. The mariner must be made aware of these changes so that a safe passage for his ship can be assured, and such information must reach him promptly and in a way that leaves no room for question as to meaning or authenticity.

Our efforts to keep our charts current may well be illustrated by an incident which has been repeated at the Hydrographic Office. We have actually had to stop a press and correct a plate while the chart was being printed in order to incorporate information which had just been received by radio. In fact, a not inconsiderable part of our effort is devoted to keeping our products current and to disseminating by rapid means immediate corrections which the mariner must have for safe navigation. One might say that our business is your safety and your interests when you or the ship that you own are at sea.

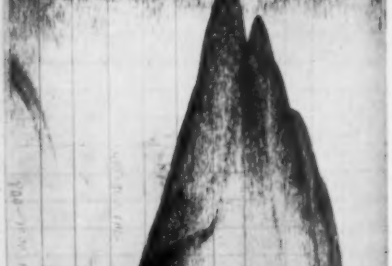
Information on all these changes flows into the Hydrographic Office from foreign offices, surveys, mariners, and naval attaches at a rate that is gratifying but also often alarming, making an adequate chart revision program as difficult as it is essential.

TECHNOLOGICAL ADVANCES

While the world's biggest charting job certainly has its share of problems and difficulties, recent technological advances, as well as those still in the research and development stages, offer hope for some improvement in the near future. Perhaps one of the most useful new tools for the hydrographic surveyor is Loran-C, a longer-range development of Standard Loran used for oceanic navigation. Loran-C, which makes a phase comparison of the transmitted signals, is more accurate than Standard Loran by far and will permit more adequate charting of the ocean floor.

Equipment for recording depth information from sonic sounding equipment is being continually improved. At present, Precision Depth Recorders, which use rolls of 19-inch-wide graph paper, plot bottom profiles ob-

Trace made aboard the U. S. Submarine SKATE while at the North Pole on 17 March 1959. Indicated depth is 2208 fathoms, uncorrected for submarine depth.



Typical return from complex bottom near Bermuda. Vertical exaggeration about 20:1.

FIGURE 2.—Precision Depth Recorder traces at the North Pole and near Bermuda.

tained with stabilized, narrow-beam transducers having a 6° beam width. This means that at a depth of a mile the diameter of the sonic cone is approximately 1/10 mile, rather than a mile, as mentioned previously in connection with a 60° beam width. The narrow beam thus greatly increases the resolution and accuracy of the bottom profiles. Figure 2 shows profiles of the relatively flat bottom at the North Pole and a complex bottom near Bermuda. To cope with the growing problem of storing these recorded profiles, the Hydrographic Office has recently acquired a continuous-strip camera which, with minor modifications, will make it possible to photograph in the office the 19-inch-wide recorder rolls on 35 mm. film. This will reduce the office stowage space and permit use of viewers and printers for easy review and reproduction.

Within the Navy research and development program we have placed a requirement for a transverse-profile sounder. As conceived, this will be a pulsed sonar and positioning system that will scan the sea bottom transverse to the course of a survey ship and automatically plot depth contours in the area scanned.

Whenever possible, the Hydrographic Office takes advantage of technological advances to improve the efficiency of survey and office operations. To further improve our operations, we are planning a research and development program that will include, in addition to the transverse-profile sounder, such items as untended ranging beacons, computers to transform hyperbolic readings to rectangular coordinates, and robot sounding boats.

Along with the technological advances planned and underway in survey equipment, two office techniques intended to provide the mariner with a better chart are worthy of mention. The first of these is the use of relief shading with both topographic and bathymetric contours to provide a picture that shows quickly and accurately the important features necessary for navigation. Although shaded relief is neither new nor unique with the Hydrographic Office, we do feel that the work we have done in this area of cartographic expression is of major help to the chart user.

An interesting and important advantage of the method of relief portrayal is that the mariner is provided with a reasonable facsimile of the picture he will see on the radar scope, thus facilitating identification of coastal features and aiding position determination by radar.

The second technique we are trying out may relieve the navigator of the messy task of pasting correction sheets on his chart. Often the area of a chart needing correction is small, making a reprint of the entire chart undesirable. To be able to get these vital changes to the chart user promptly, small sheets showing only the revised area are printed and sent out in the weekly "Notices to Mariners." At present, the edges of the pasted chartlets are not secure, and tend to catch the edges of parallel rules, etc. as they are moved across the chart. However, if we print the chartlets on paper backed with a thin heat-sensitive adhesive, the chartlet can be ironed onto the chart tightly and with very secure edges. For the quartermaster who shuns modern improvements or who does not have a flatiron handy, the sheets can still be pasted on in the old-fashioned way.

INTERNATIONAL COOPERATION

For the hydrographic offices of the world to acquire the corrective information needed to keep nautical charts current requires substantial and effective international cooperation, on both informal and formal levels. Fortunately such cooperation does exist and is one of the best examples of the benefits to be derived from friendly relations with other nations. Only last summer, I had the pleasant experience of visiting the Hydrographers of Brazil, Argentina, Chile, and Peru and was able to broach discussions leading to possible reciprocal arrangements for the U.S. to reproduce the nautical charts of these countries, similar to agreements we now have with Canada, Germany, and the Philippines.

For the formal coordination of international hydrographic matters, we take full

advantage of the International Hydrographic Bureau in Monaco. The Bureau was founded to standardize nautical charts and related publications, to improve hydrographic survey practices, and to establish close and permanent associations among all hydrographic services. To achieve these broad objectives, the International Hydrographic Bureau at Monaco holds conferences at five year intervals, attended by representatives from the thirty-eight member countries. At Monaco, and at subsequent meetings among the officials who become acquainted there, occur the kind of direct and friendly discussions that the President has urged so frequently in his "people to people" concept of diplomacy. That such discussions do more than promote international understanding is our very good fortune, for they go far to hasten the day of fuller understanding and knowledge of this substantial part of our planet so important to our present and future well being—so important to the maintenance of peace.

Miller's Ridge

The late W. H. Miller, formerly Director, Surveys and Mapping Branch, Department of Mines and Technical Surveys (Canada) and a director of the ACSM in 1953–1954, was honored at the last annual meeting of the Canadian Board of Geographical Names by the naming of a 16-mile ridge, near Carmacks in central Yukon, as "Miller's Ridge." It was in this area that the late Mr. Miller laid out a base line for the "4-mile" topographic mapping in the area. This was the beginning of the "4-mile" series in Canada.

Bibliographical Material Needed

The Publications Committee of the Property Surveys Division, ACSM, is currently engaged in compiling a complete and expansive bibliography of property surveying literature and reference material. Besides the numerous books, material is sought from articles, papers, manuals, and pamphlets.

When completed, the bibliography will be of tremendous benefit to all who are engaged or have an interest in property surveys. Nearly six hundred items have been collected so far, and it is anticipated that the total may exceed a thousand!

The committee would like information about the many excellent articles that have appeared in proceedings, short-course manuals, and State organization journals. Even the old books are of interest to the committee. Any information of this nature will be most appreciated.

Correspondence should be sent to the Committee Chairman, Winfield H. Eldridge, Room 205 Surveying Building, University of Illinois, Urbana, Illinois.

Datum Translation

By DONALD W. STIPP

LOS ANGELES COUNTY ROAD DEPARTMENT

THE MAINTENANCE of a usable level net in areas where the earth's surface undergoes continual subsidence has long been a dilemma of topographic and construction surveyors. This natural phenomenon is somewhat of a nuisance to the geodetic surveyor, frequently requiring him to rerun and readjust his nets in order that published elevations will indicate the true vertical distance between a given bench mark and the geoid. Having completed this rather clearly defined function, he has satisfactorily met his obligation to the users of his net.

This phenomenon is considerably more than a nuisance to the topographic and construction engineer, however, and the means of resolving the problem to accommodate his needs is often obscure. If the assigned elevation of a bench mark is changed, all maps, plans, and surveys which have been predicated upon that mark become alien to subsequent work. On the other hand, if the indicated differences in elevation between bench marks is not true, reasonable joins, connections, and errors of closure cannot be expected in the field. The Los Angeles County Road Department, as a matter of necessity, in correlating dozens of construction jobs in these areas has developed a technique which is proving a giant step forward in minimizing problems of this type.

Generally speaking, the construction surveyor need not be too concerned about the absolute elevation of a given mark above the geoid. He is more interested in the vertical relationship, or distance, between the bench mark, the natural topography, and the fixed engineering works he is expected to correlate. Usually, when subsidence occurs, the bench marks, topography, fixed works, etc., within a limited area of several blocks all move together and their vertical relationship changes but little. If many surveys, involving cross sections and supplementary vertical control, have been based on a certain elevation at a particular bench mark, it is obviously desirable to continue using that elevation so that old and future surveys will be compatible, even though it is known full well that the area has subsided and the elevations obtained are not true distances above sea level.

At this point it would seem a rather simple solution to apply an equation to these elevations once the revised geodetic elevation of the control bench is known. However, these control bench marks are used by many private and public engineering agencies as a basis for a variety of interrelated projects. To require that all the elevations shown in this multitude of surveys and plans should be changed is of course unreasonable. Furthermore, about the third or fourth time the elevation of the control bench mark was revised, it would be quite troublesome to determine the correct equation to be applied to a particular survey or plan. Multiply the above confusion by several hundred bench marks, each one subsiding at a different rate, and some idea of the complications arising from attempting to maintain strictly geodetic elevations is realized. Nevertheless, this Department must supply elevations for bench marks over a wide area with full assurance that surveys and designs extended from one toward another will join properly in the field, subsidence notwithstanding. Our technique in coping with this problem can probably be best explained by following through its development in the pilot case.

Early in 1957, in anticipation of extensive real estate development in the Antelope Valley, a precise level net covering about fifty square miles was run, adjusted, and published. Previous USC&GS runs through the area indicated we could expect subsidence trouble near the town of Lancaster. Within six months, deterioration of the accuracy of the net in that area became evi-

dent, but by this time we were well committed to the published elevations and revision of these record elevations was out of the question. The first impulse was to instruct users of the net to force closures between bench marks regardless of the magnitude of the error of closure encountered in the field. This policy could not be countenanced for several reasons: (1) Actual mistakes in leveling would not be detected and would be improperly adjusted out. (2) The small percentage of bench marks that become locally disturbed would introduce an extraneous distortion of the net. These bench marks should be reset in their original position. (3) This type of adjustment would be valid only if the leveling was run in a straight line between benches.

By 1959 the distortion of the net due to subsidence was making the record elevations well nigh untenable. It was reasoned that, if we were going to have to live with the elevations determined in 1957, we must ascertain the present position of the datum surface indicated by these record elevations. In other words, holding to the record elevation at each bench mark, the points of zero elevation under the bench marks define a datum surface which was once the geoid but now has been distorted due to subsidence. If we could run levels parallel to this distorted surface we could expect to check the 1957 elevation at any bench mark, all jobs would join properly in the field, and even new bench marks could be set and control extended on the 1957 datum within the subsidence area as well as without. Since instrument makers have yet to devise a level that will propagate lines parallel to a tilted undulating surface, this end was achieved through mathematics. It must be remembered that the subsidence is going on continuously.

The premise of the mathematical approach was that segments of the distorted datum surface could be adequately represented over an area of one or two square miles by a plane sinking vertically and tilting about some axis either within or without the plane itself. For mathematical convenience the tilting action would be resolved into a component parallel to the Y coordinate axis and another component parallel to the X axis.

The first step in determining the present position of the 1957 datum surface was to rerun a portion of the net. This was undertaken in the summer of 1959. The urgency of the situation and other demands upon the services of the level party precluded bringing in control from outside the subsidence area. Holding to the record elevation of a single, arbitrarily-selected, control bench mark, about eight square miles of the net within the subsidence area was rerun as required by development activity. The small net was given a free adjustment by conventional methods. The resulting elevations, which we call "field elevations" defined at that time a "field datum," parallel to the geoid but below it by some amount.

By subtracting the field elevations from the recorded 1957 elevations, we obtain the relationship at each bench mark between the field datum and the 1957 datum. Some of these differences are positive and some are negative because some of the benches are subsiding more rapidly than the arbitrarily-selected, control bench, and others are subsiding more slowly.

Next, a map of the area was prepared showing the horizontal position of each bench mark. At each bench location the difference between the field datum and the 1957 datum was noted. Lines like contour lines were then sketched on the map indicating lines of equal subsidence. This map was used to determine the limits of the plane surfaces that together were to represent the distorted 1957 datum surface. Contours on plane surfaces are, of course, straight, parallel, and evenly spaced. Areas where the lines of equal subsidence approached these desired requirements as closely as possible were delineated and the limits of the individual planes thus established.

By setting the x and y axes of a space-coordinate system in the field datum, the equation,

$$c = Mx + Ny + a, \qquad (1)$$

expresses the vertical distance between the field datum and a point in a plane, where x and y are the easting and northing, respectively, of the point from the arbitrarily

selected control bench mark, M is the gradient of the plane parallel to the x axis, N is the gradient parallel to the y axis, and a is the vertical distance between the field datum and the plane at the control bench mark. Our purpose was to fit this limited plane as closely as possible to the 1957 datum.[1] It is believed that this can best be achieved through application of the theory of least squares.

The variation at a particular bench mark between this "best" plane and the 1957 datum may be expressed

$$v = d - c, \qquad (2)$$

where v is the variation, d is the previously determined difference between the field datum and the 1957 datum, and c is as expressed in equation (1). Substituting, we have

$$v = d - (Mx + Ny + a). \qquad (3)$$

At any bench mark d, x, and y are known, therefore v becomes a function of M, N, and a. Expressing v in this manner at each bench mark within the plane, squaring the expressions and adding them together we have an expression for the sum of the squares of the variations in terms of M, N, and a. Taking partial derivatives of this expression with respect to M, N, and a, we find the rate that the sum of the squares of the variations is increasing with respect to these variables. Since we want this sum to be the minimum, we set the three derivatives equal to zero and solve the three equations simultaneously. The values of M, N, and a for the best plane were thus determined. This process was repeated for each of five planes.

We were anxious to test the validity of our original premise and see how closely the several planes approximated the 1957 datum surface. The variation between the two surfaces was determined at each bench mark through the application of equation (3) using the appropriate values of M, N, and a in each plane. The probable error of variation over approximately eight square miles as indicated by 110 redundant points of comparison was less than 0.03 foot. The algebraic sum of the differences was, of course, zero. (The indicated tilt of the planes was about 0.5 foot per mile and in the shape of a shallow bowl.)

At this point we were able to detect readily those bench marks which had been locally disturbed. In these cases the d in equation (3) would be faulty causing the v to run up to 5 or 6 times the probable error of 0.03. Isolating these "renegades" had been next to impossible before the development of this system, and in some cases good benches had been ignored and faulty ones accepted. Technically, the equations of the various planes should have been redetermined excluding the faulty benches. However, their effect was considered to be unimportant for our purposes. The obviously faulty benches may be detected and eliminated at the time the "contour" map is prepared. Unnecessary labor and conjecture in the office can be minimized by reporting the condition of the benches during leveling operations.

Getting back to the "good" bench marks, we now have the x and y components of the tilt of the 1957 datum surface with respect to the geoid within practical tolerances represented by M and N. (More exactly we have the variation between the normals of the two surfaces). Therefore, in the summer of 1959 it would have been possible to begin a line of levels with the 1957 elevation at a bench mark and proceed to any other bench, correct the elevation obtained there by M times the easting of the run, plus N times the northing (westings and southings being negative), and check the 1957 elevation with a probable error of less than 0.03 foot, plus or minus field errors.

Since the ground is continuously subsiding, it is necessary to extrapolate this information for current work. Since the values of M and N represent the accumulated tilting over a two and one-half year period, they were divided by 2.5 to get the yearly change. Future levels may give us a more sophisticated curve upon which to

[1] The original 1957 datum and the field datum are considered as plane rather than geoidal surfaces for mathematical convenience. Since the effects of curvature and gravitational anomalies are the same in both instances, they may be disregarded when distances between the two surfaces are being considered.

predict tilt factors. Our current correction formulae take the form

$$c = (mx + ny)\,t \qquad (4)$$

where c is the correction applied to field elevations to equal 1957 elevations, m is $M/2.5$, n is $N/2.5$, and t is the elapsed time in years (and decimal thereof) since January 1957.

Maps are available showing the limits of the several planes, the values of m and n to be used in each plane, and the horizontal positions of 125 control bench marks in the subsidence area. When a level run is initiated at one of these control benches and closes upon another, the surveyor need only to scale the northing and easting of his run from the map, note the elapsed time since January 1957, and apply the correction from equation (4) to his closing elevation to determine his error of closure. When supplementary vertical control is being established, the northing and easting of each new bench mark from the starting bench is determined by scaling from a map, and the correction from equation (4) is applied to each field elevation to convert to 1957 datum. When passing from one plane to another, the values for m and n change when the imaginary boundary line common to both planes is crossed in the field.

This entire technique of recovering and using distorted or obscure datums of record has been called "Datum Translation," or (in keeping with modern trends) simply "Datran." It follows that we call the planes Datran planes, and equation (4) yields Datran corrections which, when applied to field elevations, give Datran elevations which are very close approximations of record elevations.

At this writing, no analytical compilation of errors of closure obtained since the inception of Datran has been made. However, it is readily apparent that the number of costly and frustrating reruns to find out "what happened?" has been sharply reduced. Spur lines have been extended from bench marks and successfuly closed upon by levels coming from the other direction through the application of Datran. In short, it has met our need of retaining record elevations while providing for checks on errors of closure and joins in the field.

It should be mentioned at this point that *the fluids in Los Angeles County have steadfastly refused to accept a normal to our Datran planes as a valid substitute for the gravitation vector.* Consequently, plans using Datran elevations do not indicate the true hydraulic gradient that will be experienced by the fluids. Far from being a handicap, however, this feature is one of the most important results of the Datran process. The error between the hydraulic gradient and the Datran gradient along any line may be determined from equation (4). Futhermore, the yearly change in the gradient of the completed structure due to subsidence is indicated by the values of m and n. In areas where flat gradients are unavoidable, different, standard, minimum grades may be adopted depending upon whether the structure gradient will be improved or worsened by the tilting action of the subsidence.

To digress for a moment, it is interesting to note how truth, in whatever form, seems always to prevail. We could not keep our datum from tilting, so here, after the expenditure of considerable technical effort and mathematical analysis, we find ourselves runing levels on a slant in direct compliance with the old adage, "If you can't whip 'em, join 'em."

This paper has been submitted in the hope that others, confronted with similar problems, may find food for thought in Datran techniques.

Let's see now—What is the definition of a level surface?

Discussion by James B. Small, Chief, Leveling Branch, U. S. Coast and Geodetic Survey

Mr. Stipp's paper presents an ingenious approach to the difficult problem of determining vertical control by local engineers in a subsiding area. As long as the inherent difficulties and pitfalls in this expedient method are recognized by all users of the resulting control data, it may present a technique of practical value to lower-order leveling in areas of settlement.

However, it is believed this method should not be considered as a panacea for the varied and multiple problems presented to engineers

in such areas. Repeated levelings by the U. S. Coast and Geodetic Survey in settlement areas indicate that settlement rates at individual marks are not constant, but vary in an unpredictable manner between levelings. In many areas of California, unpredictable changes can take place through earthquakes or gradual movements caused by underlying tectonic forces. In some areas of variable topography there is not only no reason to correlate settlements with relative northings and eastings from an arbitrary control point, but also actual physical reasons for believing no such correlation could exist. Once a settlement rate has been established by two levelings in an area, for how long a period will the settlement rates be extrapolated? What procedures will be followed if a later third leveling indicates substantial changes in settlement rates? Will sewer lines, drainage systems, and other construction work be done under the assumption that a moving area is stable because there is little or no change in the published elevations? Mr. Stipp has admitted certain limitations in "datum-translation" techniques, and understands the difficulties involved sufficiently to avoid major problems, but it is believed that the long-range implications of this method should be carefully considered before it is given anything but experimental or expedient adoption.

ACSM Financial and Administrative Matters Committee

ACSM's new President, Brother B. Austin Barry, F.S.C., has appointed a task committee—John M. McAlinden (Chairman) Victor H. Ghent, and Clifford A. Thorpe, Jr.—to restudy quickly the progressive reports of previous committees on directional growth and organizational structure with the view of adjusting findings to suit the presently growing professional activities of the ACSM with its projected development and importance, and with its steadily increasing obligations. The Committee is charged to make critical analysis of present trends and future needs, costs, and ways and means to operate an expanded professional organization. It is further charged to make recommendations on the advisability of increasing dues in keeping with expanded expenditures necessarily concerned with the development of professional stature in the very near future.

The Committee is further charged to report to President Barry at a very early date, in fact, probably before you read this notice. In clearing your thinking for reaction to the Committee's probable findings, it may help you to see your obligation clearly if we take the ACSM's 21st birthday as the watchword. The ACSM has finally achieved maturity, no longer can its foster parents be expected to pick up the hats, coats, and shoes of this growing youngster—in fact, the ACSM, and that means the membership, must think seriously about providing for itself, let alone help with the servicing.

—W. S. Dix
Executive Secretary, ACSM

Western Regional Conference, ACSM, 1961

The Western Regional Conference of the ACSM will be held in the Valley of the Sun, October 18–21, 1961. Conference meetings will be held in the Thunderbird Room of the Westward Ho Hotel, Phoenix, Arizona, with registration in the beautiful Kachina Lounge.

Social events will include a "chuck wagon" style dinner on the Arizona desert and a visit to the Pueblo Grande Indian ruins. An informal western atmosphere is planned for all events, with many unique activities for the ladies.

Many commercial exhibitors have requested space, and the program committee has procured a panel of speakers that will be outstanding.

Every sign points to a wonderful conference, so why not plan your fall vacation for Phoenix and the October Conference where a real western welcome is awaiting you.

An Exhibitor's Invitation has been prepared and distributed covering the Western Regional Conference. This is an excellent brochure and Carl Chadwick and Troy Smith of the Exhibitors Committee are to be congratulated on their work.

Many exhibitors have already taken space and any interested should contact Exhibitors Committee, 3131 E. Cypress, Phoenix 8, Arizona, immediately.

—Clyde L. Armstrong
Convention Chairman

An Experiment in Selecting Value Scales for Statistical Distribution Maps

By GWEN M. SCHULTZ[1]

ASSISTANT PROFESSOR OF GEOGRAPHY, UNIVERSITY OF WISCONSON

MAP MAKERS and map readers, confronted with a statistical distribution map, find themselves asking, "Is the scale of values on this map wisely chosen, or should a different gradation have been used?" There exists, of course, no clear-cut rule for devising a graduated scale of values or selecting intervals in that scale. One must make his selection on the basis of personal judgment and experimentation.

A sample study is here outlined to illustrate the decisions a cartographer might face in formulating a scale of values. It takes us to the drafting-table stage where we can see what perplexing problems plague him and how he resolves them. In this study a series of statistical maps of the Milwaukee area is used. An urban sample seemed appropriate since an increase in urban-area mapping can be anticipated. The ideas are just as pertinent for other maps, however.

Our hypothetical cartographer has prepared for publication a set of four maps showing distribution of selected types of dwelling units in the Milwaukee metropolitan area, based upon data from *United States Census of Population: 1950, Volume III, Census Tract Statistics,* Chapter 32, Table 3. The finished maps, as they might appear in print in a professional journal are presented as Maps I, II, III, and IV. We want to know why he chose the value scales he did. Certainly there were other possibilities. Why were the latter discarded?

When a variety of suitable choices is available to the cartographer, how can he be sure he is selecting the best? He should have, of course, the soundest possible defense for his choice. It is possible for a mapper, after careful inspection and forethought, to draw his scale of values in his legend box, secure in the knowledge that only that scale is right. But if he has failed to experiment with different scales for what they might disclose, he is not being fair to himself as a researcher nor to his readers. By experimenting he will either uncover new and meaningful facets, or confirm his belief that his first choice was best. Either way he will have obtained indispensable information. For every map in print a number of trial maps have been consigned to some wastebasket, or perhaps should have been.

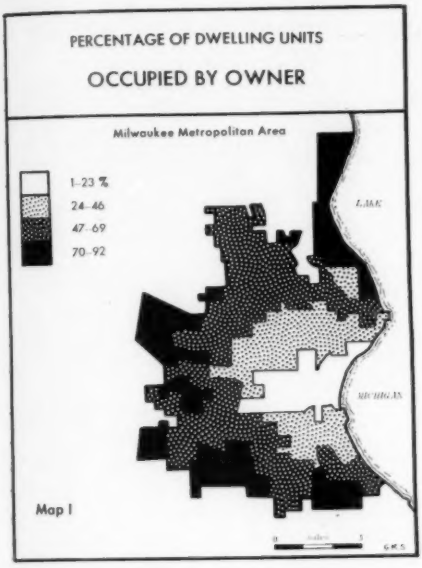
Let's look over our cartographer's shoulder, as he starts to prepare his maps, and observe his methods and mistakes. We may not agree with his decisions, which must be partly subjective, but we will at least understand why he made them.[2] He probably asks himself those two familiar questions: How many categories shall I use?" and "What value shall I assign to each category?" The answer to one hinges on the other, so he must tackle them simultaneously, using various combinations in trial maps. Our map maker realizes that mathematically the number of mappable possibilities is limitless so he narrows down the range of choices by giving careful consideration to: 1. the maps' *purpose,* 2. their visual *attractiveness,* and 3. their probable *size* in print.

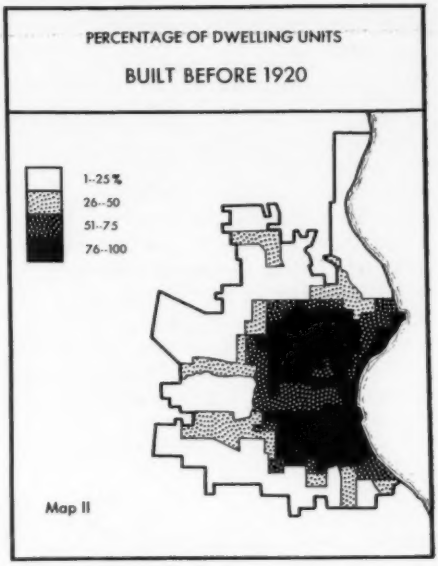
Purpose:

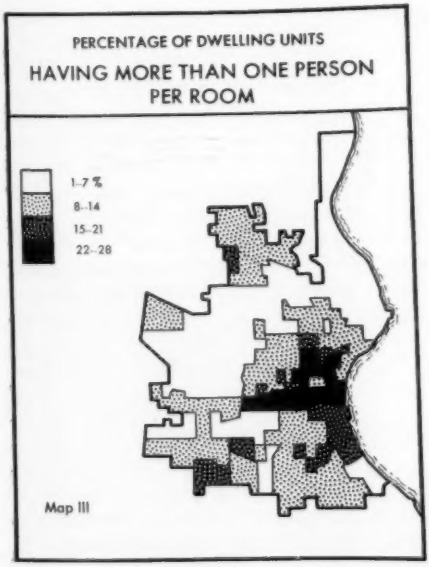
His purpose is to show distribution patterns of housing characteristics for readers of a professional journal. If the maps were aimed at a less discerning audience of, say, youngsters or nonprofessionals, he would

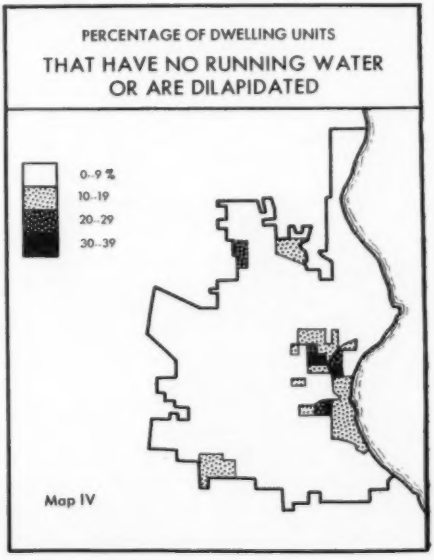
[1] With suggestions from Professors John Alexander, Arthur Robinson and Randall Sale of the University of Wisconsin.

[2] Although this discussion pertains to choropleth maps, the principles involved can be applied to isopleth maps as well.









perhaps use a small number of categories for simplification. On the other hand, if his audience consisted of urban specialists or advanced researchers he would strive for maximum detail to reveal interesting subleties. But his present objective is between the extremes—not so refined as to repel a nonspecialist, nor so vapid as to be

uninformative—something easily understood that adequately and accurately illustrates his topic.

Visual attractiveness:

Our cartographer recalls that a map should be easy to look at, easy to understand, easy to remember. Statistical maps are not renowned for their beauty. Information on a map, like food on a plate, should be appealing if it is to be consumed. If a map is cluttered and jumbled—a migraine headache framed in black—it will not educate readers. It may not even *have* readers. In contrast, a map can be *too* pleasing to look at. For example, it may employ just two categories, in which case it may resemble a calm, empty horizon—pleasant to look at, but featureless and uninstructive.

Size:

After considering the format of the professional journal, our cartographer judges that his printed maps will be half a page wide. He takes into account readability at that size, the purpose of his maps, and the desired appearance, and figures that the optimum number of categories should be three to six. The number, he feels, should be the same for all four maps to create uniformity and to facilitate comparisons.

SELECTING THE NUMBER OF CATEGORIES

Initially our cartographer wants a general idea of how Map I, "Percentage of Dwelling Units Occupied by Owner", will look prepared with the various number of categories. Later he will concern himself with refining the scale of values.

He therefore constructs the maps in three (Map I-3), four (Map I-4), five (Map I-5), and six categories (Map I-6). He studies them carefully. Which shall he eliminate? Map I-3, he decides, is too generalized. He wants more detail. Map I-6, on the other hand, is not generalized enough. Its greater detail, though enlightening, is not necessary, and might blur in reduction. Spaces between close lines are likely to fill in during printing and make small isolated areas unrecognizable. Moreover, because the pattern is disjointed, its effectiveness is reduced.

This leaves Maps I-4 and I-5, either of which might be acceptable. After further comparison he decides that Map I-4 is more suitable for the following reasons:

1. Map I-4 presents a smoother, clearer gradation, a more easily read and remembered picture. It better fulfills the demands of purpose, attractiveness, and size.

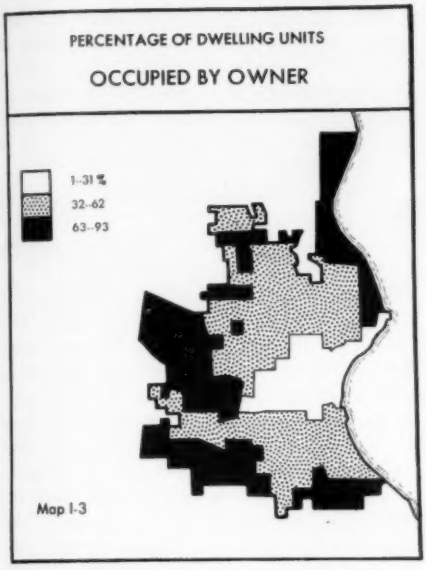
2. Greater irregularities from zone to zone in map Map I-5 suggest abrupt, complex transitions. These are, in fact, related primarily to the artificial, but governing, census tract boundaries.

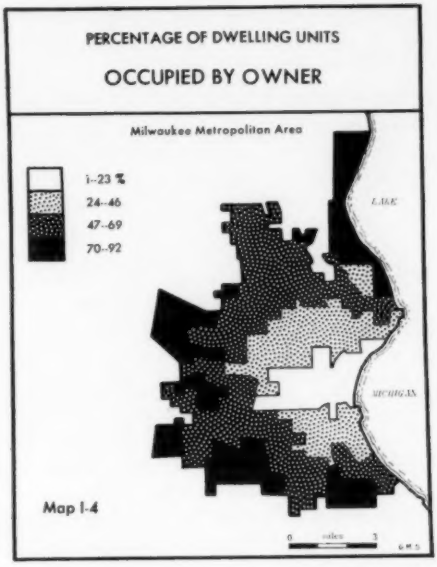
3. Map I-5 has more "islands" and "near islands" which threaten trouble in reduction. Most of the islands seem of dubious significance since they disappear when the gradation of categories is altered even slightly. (Islands are apt to exist somewhere no matter what scheme of categories is used. They are not in themselves to be considered unwelcome and often may be the most important element in a pattern.)

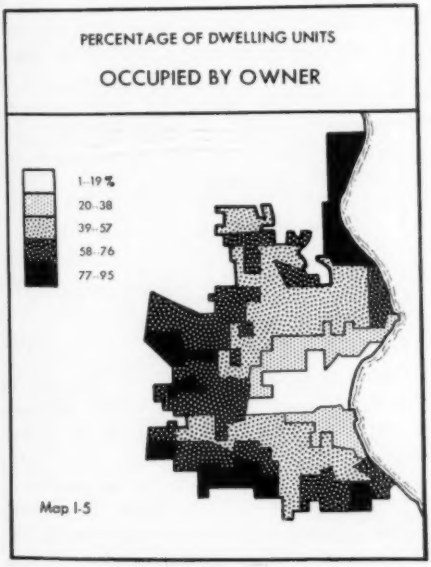
4. Whatever doubts remain are erased when this same test mapping process is applied to Maps II, III, and IV. For the whole series considered together, the most expressive and relatable patterns are obtained with the four-category maps. (Space does not permit analyzing all four maps individually, so we shall limit ourselves to consideration of Map I, realizing however that in practice evaluation of all maps of a series should be made in combination to reach any valid decision.)

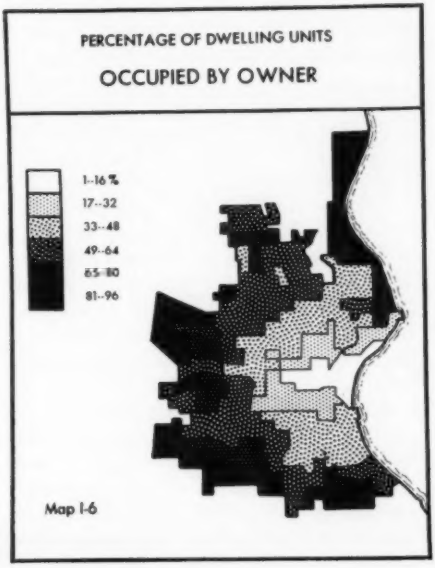
The number of percentage figures from lowest to highest in Maps II, III and IV (as in Map I) is exactly divisible by four—100, 28, and 40 (39 plus the zero), respectively, a further asset in having four categories. But let no cartographer worthy of the name base his selection of categories solely upon such an indefensible reason.

Luck so seldom smiles on a cartographer that our friend views his tentative choice skeptically. He wonders whether the method used in making his value scale (simply taking the range of percentages—


PERCENTAGE OF DWELLING UNITS
OCCUPIED BY OWNER
1–31 %
32–62
63–93
Map I-3


PERCENTAGE OF DWELLING UNITS
OCCUPIED BY OWNER
Milwaukee Metropolitan Area
1–23 %
24–46
47–69
70–92
Map I-4


PERCENTAGE OF DWELLING UNITS
OCCUPIED BY OWNER
1–19 %
20–38
39–57
58–76
77–95
Map I-5


PERCENTAGE OF DWELLING UNITS
OCCUPIED BY OWNER
1–16 %
17–32
33–48
49–64
65–80
81–96
Map I-6

from the lowest to highest—and dividing by 4) *is* the most satisfactory. He decides to explore other methods.

SELECTING THE SCALE OF VALUES

His scale of values for Map I now reads:

1–23%
24–46
47–69
70–92

Perhaps he should use instead:

1–25%
26–50
51–75
76–100

Isn't this a more conventional breakdown? Yes. More easily grasped? Yes. But he notes that this scale gives a false impression, for some census tracts appear to have percentages as high as 100%.

He recognizes that one cannot always expect a scale to divide itself conveniently into the exact number of categories desired (as 92 is divisible by 4) and that "stretching" is sometimes necessary. On trial Map I-3, he had to stretch the upper category to 93% to make it divisible by 3; on Map I-5 it was increased to 95% to be divisible by 5; and on Map I-6 to 96% to be divisible by 6. But these adjustments added weight to every "unstretched" category in the scale by lessening proportionately the possible representation of the highest category. This objection might be overcome by indicating on the map the highest actual value. On Map I-6, for example, the highest category might have been "81–92%" instead of "81–96%", but the burden of discovering the inequality would then fall on the reader. Or the cartographer might have skirted the problem by using "81% and over".

Our map maker now turns back to Map I-4, where the percentages range neatly from 1–92. He knows, even if the readers may not, that the lowest percentage is really 1.6, and the highest 91.3. He has stretched his scale at both ends to make it divisible by 4. But the adjustment, he rationalizes, is so slight and inconsequential in this particular case—a fraction of one per cent only—that an explanation would be superfluous. He feels justified in using his 1–92 figures.

But this leads to the question: Why not utilize decimals in grading the categories? One can be very precise that way, dividing by any number at all with a modicum of error. He notes how easy it is to divide 92 by 5, for instance:

0.1–18.4%
18.5–36.8
36.9–55.2
55.3–73.6
73.7–92.0

Wouldn't that be better than stretching the scale to 95% as was done on Map I-5? Maybe in some circumstances, but not here, because the impression of extreme accuracy which that scale creates is false. The census statistics from which his figures are derived do not warrant such ultra-fine grading, especially since some are based on only a twenty percent sampling. Nor is such refinement compatible with the relatively generalized portrayal of the subject. Besides, that scale is unnecessarily annoying to read.

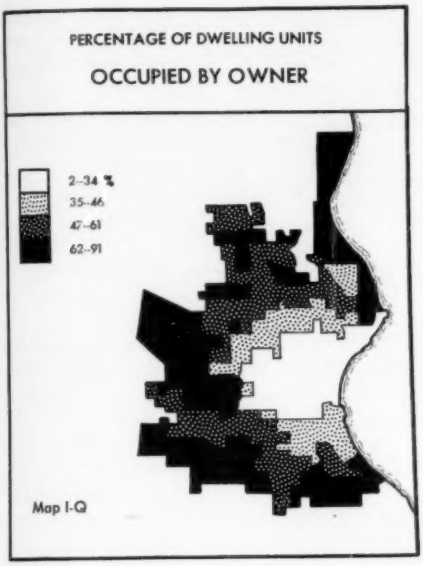
WHY NOT QUARTILES?

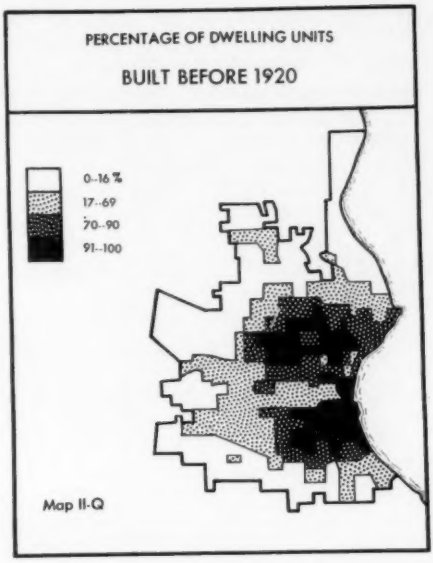
Perhaps he should use the quartile system instead. He prepares a frequency table which begins like this:

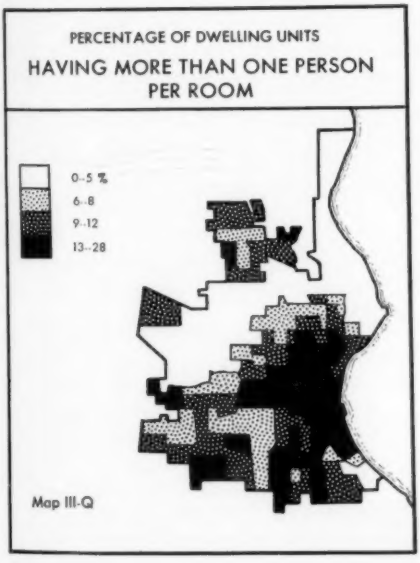
PERCENTAGE OF DWELLING UNITS OCCUPIED BY OWNER	NUMBER OF CENSUS TRACTS HAVING THAT PERCENTAGE
1 %	
2 %	/
3 %	//
4 %	/
5 %	/

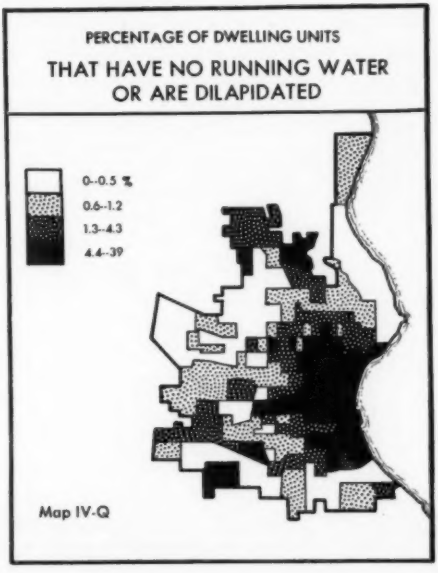
After completing the table he counts through the check marks in the right-hand column to locate the middle one, the median. Then he divides the upper and lower halves to obtain three division lines (of percentage values) which break the table into quartiles, each embodying the same number of census tracts. For Map I the quartile grouping becomes:

2–34%
35–46
47–61
62–91









He redraws his original Maps I, II, III, and IV on the quartile system as Maps I-Q, II-Q, III-Q, and IV-Q, respectively. The result is striking. To a statistician, the quartile maps tell a meaningful story in familiar language. To one less statistically minded they may be grossly misleading.

Although Maps I and I-Q display much similarity, the visual differences in the other pairs of maps are considerable, especially

in Maps IV and IV-Q. Whereas Map IV, as though it had a built-in frequency table, tells the reader that only a very small part of the Milwaukee metropolitan area has a significant percentage of dwelling units in the no-running-water-or-dilapidated class, Map IV-Q might lead one to believe that this condition is widespread, unless he analyzes the legend. However, a map itself speaks louder than its legend. The legend in Map IV-Q, moreover, draws a demerit from our cartographer because it employs decimals, which he has already concluded suggest an accuracy not inherent in the data.

The quartile system seems undesirable in this map series for another reason. The census tracts vary greatly in size. Therefore, though each of the four categories covers the same number of tracts, it does not cover the same area, and one tract can, wrongly, dominate the picture.

USING NATURAL BREAKS

Another method of calculating categories suggests itself to our cartographer, that of placing divisions where natural breaks occur, however unevenly they may divide. The breaks are low spots in the frequency table or frequency graph (a frequency table adapted to graph form). This appears to be a commendable method, until he finds that the figures in this study do not cooperate in providing significant, usable breaks. He, therefore, reverts to his original, more arbitrary method.

THE CARTOGRAPHER'S CONSCIENCE

There are, of course, other methods of determining categories for statistical maps. A cartographer must be ready to free himself from the rigidity of convention and seek new ones when occasion demands, exploring all avenues and bravely selecting the one he believes best serves his subject.

It is hoped that from this paper's organization it will not erroneously be inferred that a cartographer selects his method and then proceeds to show why other methods are inferior. The order of trials and errors was used only to facilitate presentation of ideas.

It is hoped also that cartographers will not base their selection of categories upon spurious, unconscionable, though not-unheard-of considerations as the following:

1. Which map best camouflages a certain condition for which I have no explanation?
2. Which categories, by distortion, most enhance the point of my thesis and minimize evidence that would discredit it?
3. Which method will not contradict too openly what I have presented elsewhere?
4. On which maps will it be easiest to arrange Zip-A-Tone patterns?

There are, obviously, some points that have not been touched upon in this paper, as the subject is practically inexhaustible. Enough has been said, however, to show that a skilled cartographer can manipulate his map like a musician does his instrument, bringing out the quality he wants. By altering one map's scale of values he can compile several maps to illustrate the same thing—each one different but each "accurate"—and then use the one which best meets his objective.

He may create a smoothly-graded pattern—or one that highlights irregularities. He may exaggerate extremes—or minimize them. Under some circumstances it might be inadvisable deliberately to do this; under other circumstances it might offer the best solution.

One should be alert to the power a pen wields so as to utilize the most effective techniques in composing maps; and to be on guard against those practices which mislead or distort, whether by intent or through ignorance.

Each cartographer must experiment and make his own decisions. Despite all rules and admonitions, when he sits at his drafting table it will be his own insight, judgment, and integrity which determine what values to use and where to draw his lines.

Teaching Geodetic Science in College

By SHUH-CHAI LEE

INSTITUTE OF GEODESY, PHOTOGRAMMETRY AND CARTOGRAPHY, OHIO STATE UNIVERSITY

THE GENERAL TERM, geodetic science, includes geodesy, photogrammetry, cartography, and surveying and mapping; all of which are concerned with measurements of the earth, measurements on the earth, or the representation of these measurements.

Geodesy is one of the oldest sciences in the world and it involves the measurement of the size and shape of the earth. This determination is a fundamental problem of geodetic science, and it is closely related to astronomy, physics and mathematics.

The art of map projection and map construction is called cartography. Maps and charts show the configuration, physiographical and cultural features of the earth's surface. Such maps have been made and used by geographers, navigators, geologists, and military men for centuries.

The work of land surveyors, engineers, topographers, and foresters involves the collection of data for maps. This branch of the geodetic science is called surveying and mapping. Photogrammetry is a type of mapping that is carried out with limited field work. Photogrammetric maps are constructed faster and easier by making measurements on photographs.

Geodetic science has a common scientific background with many fields of study, but only a few universities have an independent and comprehensive curriculum for training students. In the United States, Ohio State University has an Institute of Geodesy, Photogrammetry and Cartography. In Europe, the motherland of geodetic science, the mathematical and physical aspects of geodesy have been emphasized. Other countries of the world have independent geodetic institutions which have professional training programs. However, some of these are for military purposes. Such is the case in China.

In this country, civil engineering graduates are usually considered the only source of technical people trained in surveying and photogrammetry. Often cartography, mapping, and surveying are supplementary or elective courses of other fields of study such as geography, geology, forestry, architecture, mining, horticulture, and agricultural engineering. In most cases, extensive study in the civil engineering field is not stressed.

The present status of geodetic science being taught in colleges varies greatly to meet many training requirements. Often technical training is emphasized at the expense of scientific background. In recent years the number of surveying courses in the civil engineering curriculum has diminished. This may be due to the expansion of other areas of study or the assignment of young, inexperienced, or reluctant instructors to the teaching task. The worst fact is that engineering students dislike the tedious computation and drawing, and the manual work of field surveying. At any rate, geodetic science is losing its position of significance in the minds of both students and teachers.

The teaching of this science in colleges needs a cooperative plan and a sound program. These are needed, not only because of the increasing demand for geodetic scientists in this age of space exploration and resources development, but also for the effective use of the facilities and personnel of the modern university. In these respects, Ohio State University's Institute of Geodesy, Photogrammetry and Cartography is a good example. This Institute is well organized in relation to faculty, laboratories, and the departments of Mathematics, Physics and Astronomy, Geology, Geography, and Civil Engineering. The curriculum of this Institute is comprehensive and suitable for the training of undergraduate and graduate students who are preparing themselves as high-quality professional men or future college teachers.

Not all universities would have to offer or could present the graduate-level instruction in geodetic science mentioned above. But if a university has the departments of civil engineering, geography, geology and, of course, mathematics and physics, the curriculum of geodetic science for a Bachelor's degree can be arranged in accordance with the needs of the community or the country. This should be the direction of development of surveying and mapping education in future years.

If some courses in geodetic science are offered but a degree program is not present at a university, as is often the case, the contents of the courses still have to be well planned and organized. For example, surveying and photogrammetry are two basic courses in civil engineering. But some teachers emphasize the technical and engineering phase with few words about the geodetic and mapping significance. Cartography teachers sometimes do not mention the surveying background in the construction of maps. An over-all point of view is necessary to help students attain a thorough knowledge of this science.

Tables I, II, and III show the writer's schedules of lectures and laboratories for courses in Elementary Surveying, Advanced Surveying, and Photogrammetry in the National Taiwan University, Taiwan (Formosa), China, in the years 1951–1957. The writer does not think it is sound for every case, but it was, he believes, satisfactory for the circumstances of that university. The students came from the departments of agricultural engineering, hydraulic engineering, civil engineering, geography, geology, forestry, agronomy, and horticulture, and were at different levels of undergraduate and graduate study.

The contents of lectures and laboratories are the backbone of instruction of geodetic science. Classroom techniques also contribute substantially to successful study. Schedules should be well planned and distributed to the students at the beginning of the course. This will impress the students of the course and be helpful in its administration. The other pedagogy responsible for carrying on the schedule; stimulation of students' interest, communication of ideas, assignment of home work, handling of the students in laboratory work, examination and grading, affects the success of the teaching as a whole.

In any case, good teachers are the real agent of successful programs of geodetic science in college. They should have been trained wisely when they were in school. The curriculum for those choosing teaching as a career may not be substantially different from a professional curriculum, but future teachers must take the courses related to education and teaching techniques. Later they will carry on good teaching habits to their students.

Whether college education should be general and cultural, or intensive and specialized, has been a controversial topic for many years. In the writer's opinion, this does not constitute a problem because humanities and sciences are well offered and balanced in the curriculums of today's universities. The formulation of a good theme is up to the teacher. A good teacher should not concentrate his efforts completely in his own field, but should also pay attention to developments in other fields. If he can see beyond his own area of interest the similitude and generalization of disciplines and methods prevailing in different fields of knowledge will be appreciated and recognized.

The classroom is only one of the areas of expression for a college professor. For the good of the profession and for his own good too, research should be another facet of his activities. This is especially true in science. In geodetic science, a library with ample references and maps is indispensable. His activities should also extend to participation in local, national, and international professional societies. Exchange of information and ideas is an important part of international cooperation. To an individual, map collecting may not be as easy and popular as stamp collecting, but map appreciation can be interesting, colorful, pleasant, and historical.

The rewards of a teacher in geodetic science are the academic atmosphere of a university and the opportunity for adventure

in modern developments. This is more than a title or high salary, even though the teacher is entitled to fair treatment and rewards comparable to industry. The college teacher should have the faith Chinese scholars have by the Confucian discipline: "The great pleasure of a teacher is being with intelligent students in an intellectual atmosphere."

TABLE I. Schedule for Elementary Surveying

Week	Lecture	Laboratory
1	Introduction and Taping	Distance Measurement
2		Taping Surveys
3	Compass Surveying	Compass Traversing
4		Traverse Computations
5	Plane Table Surveying	Plane Table Traversing
6		Problems of Intersection and Resection
7		Plane Table Surveys
8	Transit Surveying	Plane Table Surveys
9		Introduction to Transit
10		Angle Measurements
11		Azimuth Traversing
12		Deflection Angle Traversing
13	Leveling	Differential Leveling
14		Profile Leveling
15		Hand Level Cross-sectioning

TABLE II. Schedule for Advanced Surveying

Week	Lecture	Laboratory
1	Control Surveys	Reconnaissance for Triangulation
2		Base Line Measurement
3		Triangulation Angle Measurement
4		Adjustment of Triangulation
5		Computation of Triangulation
6		Astronomical Determination
7		Precise Traversing
8		Precise Leveling
9	Detail Surveys	Tacheometric Surveying
10		Topographic Surveying I
11		Topographic Surveying II
12	Map Making	Hydrographic Surveying
13		Map Construction
14	Engineering Surveys	Flow Measurement
15		Engineering Curves

TABLE III. Schedule for Photogrammetry

Week	Lecture	Laboratory
1	Introduction	Cameras
2	Optics and Photography	Photography
3	Photo-geometry	Perspective Drawing
4	Terrestrial Photogrammetry	Terrestrial Photogrammetry
5	Aerial Photography	Flight Planning
6	Vertical Photographs	Vertical Photograph Analysis
7	Ground and Photo Controls	Radial Triangulation
8	Photoplanimetry	Map Compilation
9	Tilted Photographs	Tilted Photo Analysis
10	Rectification	Rectification
11	Mosaics	Mosaic Assembly
12	Oblique and Composite Photos	Oblique Photogrammetry
13	Stereophotogrammetry	Stereophotogrammetry
14	Photo Interpretation	Photo Interpretation
15	Engineering Applications	Engineering Photogrammetry

Thanks to Annual Convention Committee

The American Congress on Surveying and Mapping expresses its praise for the 1961 ASP–ACSM Convention and Exhibit Committee and the Meetings Committee workers and participants, without whom this most successful convention would not have been possible. Thanks to all for a job well done. Special thanks to Convention Director Charles W. Culkin, his deputies, and the various teams headed by them. Also special thanks to ACSM 21st Annual Meeting Chairman John M. McAlinden and his deputy Joseph P. Dunich. It was a great show, the best yet, and thanks to all.

Evening Surveying Courses at Rutgers

Rutgers – The State University has announced four evening courses in surveying for practicing civil engineers. These courses, given in cooperation by the College of Engineering and the University Extension Division, were conducted at the Surveying Laboratory on the University Heights campus. Each course included a series of 15 class meetings, as follows:

Fundamentals of Surveying, Mondays, 7:00–9:50 p.m., beginning September 19, 1960.

Photogrammetry and Air Photo Interpretation, Wednesdays, 7:00–9:50 p.m., beginning September 21, 1960.

Property Surveys, Mondays, 7:00–9:50 p.m., beginning January 30, 1961.

Curves and Earthwork, Wednesdays, 7:00–9:50 p.m., beginning February 1, 1961.

This will all be over by the time this issue of SURVEYING AND MAPPING has been published, but those within commuting distance of Rutgers University, if interested, should watch out for further announcements from the University, because this series of courses *may* be repeated another year if there is sufficient demand. Further information may be obtained from the University.

Resolution*

WHEREAS the Land Surveyors Functional Section of the New Jersey Society of Professional Engineers, through the able organization of Professor Paul P. Rice, has developed a well-conceived course in Land Surveying under its Extension School Program.

BE IT HEREBY RESOLVED that the Property Surveys Division of the American Congress on Surveying and Mapping commend Professor Rice, and through him those in New Jersey responsible, for a progressive step to improve the eductational atmosphere surrounding the Land Surveying Profession.

* Approved by the ACSM Board of Direction, March 25, 1961, for forwarding by the Property Surveys Division.

What Does the Property Surveyor Owe His Client?

By SOL A. BAUER

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EDITOR'S NOTE:—This article is a slightly revised reprint of a paper presented by Mr. Bauer at the 50th Anniversary Convention of the Ohio Title Association, and published in *Title News*, Vol. XXXVIII, Number 12. Mr. Bauer is well known to members of the ACSM, having been active in Congress affairs for the entire twenty years of its existence. He was Chairman of the Property Surveys Division for several of the early years, then, in 1950, he became President of the ACSM. He is the author of numerous articles published in SURVEYING AND MAPPING and elsewhere. The contributions to the ACSM of which he is proudest, however, are the development and publication, by committees working under his chairmanship, of the "Technical Standards For Property Surveys" and "Equitable Fees For Property Surveys."

PROPERTY SURVEYING or land surveying predates written history. It is generally believed that land surveying began in ancient Egypt along the River Nile for purposes of relocating the land boundaries of the various kingdoms after the yearly floods. It is believed that, for this purpose, base lines were fixed during the dry season on the high ground beyond the reaches of the highest flood waters. The boundary lines of the various kingdoms were then referenced to those base lines by applications of some of the simpler laws of geometry and trigonometry, and, after the floods receded, the lost boundary markers were relocated from those previously established base lines. Titles were presumably guaranteed (in those less complicated times) by the sizes of the armies of the various kingdoms.

The Bible, too, has many references to land boundaries. In fact, the Book of Joshua is largely a series of land descriptions which, incidentally, are no worse than many that are still on our deed books within this very county.

Land boundaries even in biblical days were important, and seemingly boundary disputes existed or started then. For instance, in Deuteronomy, chapter 19, verse 14, we read: "On the property which you inherit, which the Lord, your God, is giving you to occupy—You must not remove your neighbor's land mark which the early inhabitants put in place." In chapter 27, verse 17, we find: "Cursed be he who moves his neighbor's land mark and all the people shall say, 'So Be It'."

There are many other records in the Bible indicating that land ownership carried with it throughout the ages the questions of location of boundaries, their permanence, and their marking.

We surveyors do not want to compete for the title of "oldest profession in the world," but surveying apparently runs the accepted oldest profession a close second as to time, in any event, even if not in other respects.

EARLY INSTRUMENTS

During the 19th century the standard surveying equipment consisted of the open-sight compass, which was in active use from before 1842 to 1924 for observing bearings, and the Gunter chain for measuring distances. The open-sight compass supported by a single rod called the Jacob staff, and balanced by hand, was a very inaccurate instrument as compared with our present day instrumentation. Bearings could rarely be observed much closer than the nearest quarter of a degree.

The Gunter chain of 66 feet was designed by and named after Edmund Gunter, an English astronomer. He chose this particular length because 10 square chains of 66 feet on a side make one acre of 43,560 square

feet and 80 linear chains make one mile of 5,280 feet, making computations quite simple.

The Gunter chain is composed of 100 pieces of iron wire, each called a link and each about 8 inches long. Each link was bent at each end into a ring fitting into the ring of the next link. A 66-foot chain, then, was a heavy piece of equipment, and occasionally surveyors used a 50-link or 33-foot half-chain as a more manageable device. This fact often led to trouble because line lengths were recorded in terms of chains, sometimes without indication of whether a half or full chain was used. Somewhere in this county is a deed calling for distances by chains, but adjoining titles indicate that the same number of half-chains was intended. Chains were often made by the local blacksmith, each according to his own idea of the length of the 8-inch link. Even when made with thin wire, the chain was very heavy, and had to be pulled with great force at its ends to take out the sag. Such pulling tended to elongate the rings at the ends of the links, thereby increasing the length of the chain.

The Gunter chain, then, was not a precision measuring device, but it served its purpose notably for at least 100 years.

At about the beginning of this century, the surveyor's transit reading to the nearest minute of arc began to replace the open-sight compass in this vicinity, though to this day the open-sight compass is in limited use in some regions.

The surveyor's transit remained almost unchanged in design until 1921, at which time a Swiss inventor named Dr. Heinrich Wild built an optical theodolite. This is a departure from the old surveyor's transit in which the silvered circles were replaced with graduated glass cylinders and the vernier was replaced by an optical micrometer, enabling the instrument to be read by microscope to the tenth of a minute or even to the nearest second.

The surveyor's chain of 66 feet gave way at about the same time to the surveyor's tape of 100 feet in length which modern procedures can produce to a high precision and uniformity of absolute length.

The mathematics of surveying has remained as it started—that is, geometry and trigonometry.

BOUNDARY LAW

The legal phases of surveying have remained as they were, that is, based upon English Common Law, aided, abetted, and contradicted by subsequent court decisions or local custom. The law of boundaries of our courts remains to this day as the essence of land surveying.

So property surveying is a hybird art made up of two principal component parts: (1) the law, and (2) engineering. Which is the more important it is difficult to say, though clearly the legal or title phase is the more difficult, since it is not so readily reduced to sets of rules or formulae as the engineering and the mathematical phases of surveying can be and are.

Many papers and books have been written on the law of boundaries. The two best known books on the subject for use of surveyors are "Surveying and Boundaries" by Clark and "Boundaries and Adjacent Properties" by Skelton, both published by Bobbs-Merrill. Clark was a member of the Minnesota bar and Skelton was assistant professor of civil engineering at the University of Maryland.

It is an accepted fact in the profession that the legal description of a property is the controlling document governing the work of the land surveyor. One of the best papers on the subject is rightly entitled "Property Surveys Must Fit Their Titles,"[1] written by William C. Wattles of Los Angeles. Mr. Wattles, now retired, is known as the Dean of Surveyors on the West Coast, and was for a long time chief engineer for the Title Insurance and Trust Company of Los Angeles.

IMPROVEMENTS

During the last 30 years or more, great changes have taken place in the design of surveying equipment. The transit and theodolite have been improved for greater efficiency and accuracy of observation; atmospheric conditions remain the limiting

[1] *ASCE Transactions*, Vol. 115, 1950.

factor in angular accuracy. Tapes are now made of lighter and more durable steel ribbon and of more uniform absolute length, but otherwise quite like those of 30 years ago. One widely used tape, checked in our office over a period of 15 years, has an average accuracy as to absolute length of 1 part in 30,000 at 68 degrees and 20 pounds, or an average error of about 1/25th of an inch in 100 feet. At a tension of 19 pounds at 68 degrees, this tape has an average accuracy of one part in 50,000 or about 1/40th of an inch in 100 feet. The greatest problem in the matter of accurate measurement of distance by tape still remains that of determining the temperature of the tape at the time the measurement is made. Tapes are generally manufactured to be 100.00 feet long at 68 degrees with a tension of 20 pounds at the ends when supported only on the two ends, or 10 pounds when supported throughout. A fifteen-degree change of temperature will increase or decrease the length of a 100-foot tape by ⅛ of an inch, making an error of 1 part in 10,000. Careful surveying procedures require that these temperature changes be considered and that lengths of lines be corrected accordingly. For high-precision, geodetic surveying, invar tapes are used. Invar is a nickel-steel alloy and has such a low coefficient of thermal expansion (about 1/25th that of ordinary steel) that the effect of temperature change can be largely ignored. However, invar tapes have their limitations—they are prohibitively expensive and too brittle for ordinary use. They are also unstable and change in absolute length in an unpredictable manner.

The *big* change in linear measuring devices has come about in the last four or five years. There are two such new linear measuring devices. The first of these developments is the Geodimeter, developed in Sweden. This instrument employs a modulated light beam directed from an apparatus set up at one survey station to a reflector set up at a second station. "The distance between the two stations is determined as a function of the phase difference between the emitted beam and the reflected beam," (it says in the book), "and the precise value of the velocity of light." The system requires clear weather, some darkness, and an unobstructed path between the two stations. Distances up to 25 or 30 miles have been measured with an accuracy good enough for geodetic base lines. The manufacturers claim an accuracy of 1 to 2 parts per million for distances of 10 to 30 miles. The Geodimeter also gives good results for short distances. The manufacturers claim that distances as small as 50 feet can be measured with suitable accuracy. It is not affected by moving or stationary objects in the vicinity of the stations or the sight-line. Distances have been measured with the Geodimeter while a long freight train was crossing the line of sight between transmittor and reflector, enough light getting through between cars to be measurable.

Soon after the introduction of the Geodimeter, another valuable, distance-measuring device, the Tellurometer, became available. Developed in South Africa, the Tellurometer, in effect, "utilizes a modulated radio signal transmitted from a master unit set up at one survey station and received and retransmitted by a remote or slave unit set up at a second station. The phase of the return signal is compared with that of the initial signal, and the distance is derived from the phase difference and the known velocity of the radio waves." Again I quote from the book.

The Tellurometer can be operated by day or night; it can penetrate haze, smoke, fog, clouds, light rain, and even a limited amount of foliage or timber if the obstruction is not too near one of the stations. At an optimum distance of 10 to 25 miles, it has an inherent accuracy of 1 part in 300,000, plus or minus 2 inches, the 2 inches being independent of distance. Distances of 40 or more miles can be measured under favorable conditions. The Tellurometer is less accurate for distances of less than one mile since the basic error of 2 inches would be unacceptable for short lines. The system is affected by reflections from nearby moving objects such as people, vehicles, or waving grass. A year of experience by the U. S. Geological Survey indicates good results.

About 100 years ago, surveying calcula-

tions were done by graphical means—that is, by drawing the boundaries with care and scaling the wanted lengths on the drawing. The more careful practitioners who were familiar with the mathematics of trigonometry relied upon logarithms and logarithmic functions for solutions of unknowns.

Early in the 1920's the manually operated calculating machine used in conjunction with natural trigonometric functions came into wide use—to be supplanted in a short time by electrically operated automatic calculators and more recently by electronic computers. Electronic computers are appearing with surprising frequency in spite of their very great cost and the new techniques that must be learned for their operation. Much work is being done now to "program" the calculations for entire subdivisions for calculation by electronic means.

Since 1920 photogrammetry—that is, plotting or surveying from aerial photographs viewed in stereoplotting instruments—has reached a high stage of development. Stereoplotters ranging in cost from a few thousand dollars to well over a hundred thousand may be bought; and, although it is true that photogrammetry has largely replaced ground surveying methods for topographical surveys, particularly of large tracts, photogrammetry probably will not entirely replace ground methods for land surveying for a long time to come, if ever.

It should be reported, however, that photogrammetry was used for land acquisition by TVA with great success. There the problem was only that of determining area for purposes of payment for land purchase. Although it was assumed that points or lines determined photogrammetrically probably were accurate to only plus or minus 10 feet, the land values in the area were so low that this probable error did not justify the slower and more expensive, though undoubtedly more precise, ground survey method. The Land Title Guarantee and Trust Company of Cleveland used applications of photogrammetry in its title work on land acquisition for the Ohio Turnpike.

BOUNDARY TITLES

In other respects, land surveying remains dependent upon the law of boundaries as interpreted by our courts, with particular weight being given to "monuments"—whether natural, artificial, or title as by reference to boundary titles.

The level of the practice of land surveying generally varies directly with the level of title work in any given community. A "tough" title company in any community means above-average, land-surveying practice. That is probably why surveying procedures in and around large cities usually are so much more detailed than in outlying communities. Of course, high land values such as are found in and around large cities account for both better surveying and better title procedures.

ERRORS VERSUS MISTAKES

At this point, I should explain the term "accuracy" as I use it. The accuracy of an observation is measured by its "error." Please note that it is a physical impossibility to make any observation, whether of angle or distance, with absolute accuracy—that is, without error. May I point out that "error," as used here, is not the same as "mistake." Mistakes are generally large in quantity and totally unpredictable. Errors generally are small in size and generally are predictable as to effect, and thus are capable of mathematical adjustment. It may be clearer to explain that errors as referred to in measurement are similar to tolerances in dimensions of machine parts.

The recording of a wrong figure—a 6 for a 9, for example—is a mistake—a booboo or a goof, if you want—but not an error. Dropping or forgetting a tape length is a mistake. Calling a line 10 chains long when a 33-foot or half-length chain was used is a mistake, unless the chain length is stated.

The variation of length of a tape caused by changing temperatures is an error. Its probable effect can be determined, within limits, if the tape temperature is known. A tape that has been stretched by overuse creates an error. Careful observation procedures and good measuring devices permit the surveyor a high accuracy with most modern equipment. A surveying accuracy of plus or minus 1 part in 10,000 is readily

obtainable with ordinary care and good instrumentation in flat country. In fact, an accuracy of plus or minus 1 part in 20,000 is not difficult to obtain in this county. I should repeat here that the accuracy of an observation is determined by its "error" and in saying "an accuracy of 1 part in 10,000" we really mean the observation has an error of 1 part in 10,000 *or less*—that is, an error of not more than about ⅛ inch in 100 feet.

FIRST RULE OF SURVEYING

As the first rule in surveying, I would suggest: "Take nothing for granted, trust no one, not even yourself. Check and recheck everything." Don't be too ready to blame "the other guy." He is sometimes right.

It is not a surveyor's job to "fix" property lines. He is rarely in a position to "establish" a boundary line unless it is a new line just being created. Most property surveying is for the purpose of reestablishing old lines. In these cases the job of the surveyor is that of a fact-finder. Starting with the deeds of record and other pertinent data, the surveyor's job is to find all facts (both those in agreement and those in disagreement) that apply to the problem in hand and from which an opinion as to the best location of the property line can be reached.

The surveyor may express his opinion based upon the facts he has found and may accordingly recommend the use of a certain position of boundary, but as a surveyor he does not have the legal authority to "fix" a line. It is one of the interesting facts of surveying that the surveyor has no legal right to fix boundaries, that being the right only of a court of law. However, it is a strange and satisfying fact that, having none of the privileges of lawyer, judge, or court, the property surveyor can and does exert the influence of all.

ACCEPTANCE

One of the chief rewards in this profession of ours is the willingness of title companies, lawyers, courts, and owners to accept the opinion of a surveyor on matters of title, not because he has any legal status but merely because he has presented his case with a thoroughness and sound reasoning that, combined with an established reputation within his community for technical skill, knowledge, and integrity, give his work and word an authority that is accepted by those who have the power and function to translate his opinions into decisions with the weight of law. In some 35 years of practice in the city of Cleveland, this writer has appeared in court only once to dispute the work of another surveyor. It developed that we agreed. On the other hand, large numbers of titles have been changed and corrected without court action, merely because of the willingness of title companies to accept work from this and other offices where such work indicated careful, studious, and detailed investigation of conditions by surveyors of recognized professional standing. Acceptance of a title change by a major title company in practice generally carries all the weight of a court decision, since rarely is it contested. That extra-legal privilege of the surveyor is the best indication of the service he is rendering the community.

So, a surveyor of long standing and of good repute will often have his opinion accepted by attorneys, title officers, and even the courts, thereby giving his opinions the legal weight they otherwise would lack.

The land surveyor has many problems in addition to clients—or the lack of clients. One of the most trying problems that we have encountered is the unwillingness of clients (principally mortgagees and lawyers for mortgagees) to accept or even want to receive survey reports that show some difficulty of survey or title.

It would seem that, when a client decides he needs a survey, he would then want a full impartial statement of all facts pertaining to the property, favorable and adverse. However, a mortgage broker who has already resold a mortgage does not want to know that there is a title gap or building encroachment affecting the property.

The obligation of the surveyor as fact-finder is to report all facts pertinent to the property, good, bad, or indifferent. The importance of the facts is not his concern, but that of the client.

May I assure you that in 35 years of practice I have seen very few cases where a surveyor reported a situation other than as he found it. He may have been wrong in his finding but, right or wrong, that's the way he must report it. We surveyors are a stubborn lot. Stubborn and sometimes wrong but generally honest.

Too often the surveyor is expected to do title search. Many of our large industrial holdings are accumulations of purchases and accruals through street vacations, altered by half-forgotten conveyances, street alterations, and so forth. It is generally held by surveyors that the client should furnish the surveyor with a description of the land to be surveyed. Good practice often makes it advisable for the surveyor to check ownership and title through such means as he may have at his disposal. But title search is not the function of the surveyor except for verification.

Together with the surprisingly recent developments in surveying practice has come a coincidental improvement in surveying professional consciousness.

STANDARD OF PRACTICE

Until 1940 there existed in the United States no land surveyor's association of more than local scope. In that year a few leaders of surveying practice and surveying teaching formed the American Congress on Surveying and Mapping, with headquarters in Washington, which now has several thousand members in some fifty countries. In 1943 ACSM formed a committee of surveyors in private practice in all parts of the United States to formulate, for the first time in the long history of land surveying, a standard of practice for property surveying. That was in answer to the frequent question: "What have I a right to expect when I order a survey made?"

In 1946 the committee presented such a standard in the form of a three-page document to the ACSM, which approved its adoption as the official pronouncement of the criteria and requirements of a land survey properly performed in the United States.

Briefly, that document sets up standards with reference to land titles and locations as follows:

Every parcel of land whose boundaries are surveyed should be made conformable with the record title boundaries of such land.

The surveyor, prior to making such a survey, shall acquire all necessary data, including deeds, maps, certificates of title, and data on centerline and other boundary line locations in the vicinity. He shall compare and analyze all of the data obtained, and make the most nearly correct legal determination possible of the position of the boundaries of such parcel, as an office solution. He shall then make a field survey, traversing and connecting all available monuments appropriate or necessary for the location, and coordinate the facts of such survey with the predetermined analysis. Not until then shall the monuments marking the corners of such parcel be set, and such monuments shall be set in accordance with the full and most satisfactory analysis obtainable.

In reference to maps, the standards are as follows:

Every land survey requires a map properly drawn, to a convenient scale, showing *all* the information developed by the survey; also a proper caption, proper dimensions and bearings or angles, and references to all deeds and other matters of record pertinent to such survey, including monuments found and set.

SURVEYING COSTS

Along with other costs, the cost of property surveys has risen very materially since the last war. This is in part due to the fact that salaries of competent men have increased greatly, probably three times. Traffic has become so congested that survey work in city streets is greatly slowed down. In addition, surveying accuracies and the requirements of clients and title companies have increased and there is a rapidly growing problem of street monuments being destroyed. The ravages of time alone account for destruction of many monuments. The installation of utilities and building construction destroy many more monuments, but, of late, the destruction of street monuments has been going on at a wholesale rate. In blacktopping city streets, it is standard practice to lay down a uniform thickness of asphaltic concrete upon an old pavement, covering manholes, valve boxes, and monument boxes impartially. It is part of the accepted program that the paving contractor will come back, dig up the various

manholes and valve and monument boxes, and raise them to the level of the new blacktop. In spite of the fact that most contracts provide for extra payment for the raising of these structures, many times they are left buried under several inches of blacktop. Often when they are raised, the process of moving shatters the old stone monuments which they covered. In that way we lose many of our oldest street monuments. The cost of reestablishing a lost monument can add very greatly to the cost of a property survey.

It is an erroneous assumption that the cost of a property survey can be materially reduced by keeping the observational accuracies within what some people like to call "practical limitations." Actually, the only way materially to cut down the cost of property surveys is to short cut the job, i.e., to cut down on the amount of investigation, field and office, the checking of deeds and titles, the running out of lines, and the elimination of a full conformity to the calls of the deeds and titles, or, in other words, to perform in a manner short of that recommended for good practice. Such short cutting is a dangerous procedure and is the basic cause of most of our badly involved survey title problems.

DESCRIPTIONS

The practicing surveyor has many problems that cause him to age rapidly. One such problem is the matter of the legal description that ends with the statement: "According to a survey made for ..... by ..... on the date of ....." There is nothing wrong with that statement if the description which it follows has been prepared by the surveyor to whom it refers. Too often, however, the description is prepared by someone other than the surveyor. The words attached lead others to believe that the entire description and survey are the work of the surveyor. It is the opinion of this writer that it is an improper procedure for someone other than the surveyor to draw up a description and use such an ending, though it would seem that an acceptable modification might be as follows: *"The bearings and distances* contained in this description are taken from a survey made. . . ." The latter phraseology provides the information without the implication that the surveyor worded the legal description.

REWARDS

There are many other problems in the life of the practicing surveyor into which we need not go at the present time. It is a highly-detailed, painstaking job if done properly, and with small financial rewards. It has often been said that the surveyor's principal function on a construction job is to take the blame for whatever goes wrong with the job.

However, land surveying does have its rewards. Difficult surveys, if and when successfully completed, often have the fascination of a difficult puzzle, and there always remains the possible satisfaction of a job well done, because occasionally we are appreciated.

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Surveying and Mapping Literature

Members are requested to send in surveying and mapping news items for publication in SURVEYING AND MAPPING.—EDITOR.

MAGAZINE ARTICLES

General Interest

THE SURVEYOR AND HIS STATUS IN HISTORY AND TODAY. H. Biesheuvel. *The South African Survey Journal,* Vol. 9, No. 55, Part 4, December 1960. (Quotes from early treatises on surveying and a review of the present day status of the surveyor.)

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MEASUREMENT OF TIDAL CURRENTS AT LITUYA BAY (ALASKA) INTRODUCING AERIAL PHOTOGRAMMETRIC METHODS. Charles B. Taylor, Jr., and William D. Harris. *The International Hydrographic Review,* Vol. 38, No. 1, January 1961. (Describes use of photography in an area where submerged rocks and strong currents prevent the use of standard methods.)

HYDROGRAPHIC SURVEYING FOR OIL EXPLORATION. S. Herschdorfer and G. Kuipers. *The International Hydrographic Review,* Vol. 38, No. 1, January 1961. (General discussion of methods.)

THE NEW SURVEYOR. Rear Admiral H. Arnold Karo. *The International Hydrographic Review,* Vol. 38, No. 1, January 1961. (Description of one of the newest and most modern surveying vessels.)

OCEANOGRAPHIC EXPEDITION OF THE SHIP EXPLORER. Rear Admiral H. Arnold Karo. *The International Hydrographic Review,* Vol. 38, No. 1, January 1961. (Reviews accomplishments of the Coast and Geodetic Survey vessel on a 10,000-mile trip from Seattle, Washington, to Washington, D. C.)

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THE MISSILE AGE IN CIVIL ENGINEERING. G. H. Hicox. *Civil Engineering,* Vol. 31, No. 2, February 1961. (Corps of Engineers viewpoint.)

GEOLOGIC ASPECT OF COAST AND GEODETIC SURVEY OPERATIONS. Rear Admiral H. Arnold Karo. *Geo Times,* Vol. 5, No. 6, March 1961. (Extensive discussion of the contribution of the geodetic, oceanographic, hydrographic, and seismological work of the Survey to geological sciences.

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MAPPING THE LOW-WATER LINE OF THE MISSISSIPPI DELTA. Bennett G. Jones and William Shofnos. *The International Hydrographic Review,* Vol. 38, No. 1, January 1961. (Describes application of modern methods of infrared photography and photogrammetry on terrain where ground survey methods are prohibitively difficult and expensive.)

NEW METHODS OF ACHIEVING REGISTER IN CHART CONSTRUCTION AND PRINTING. *The International Hydrographic Review,* Vol. 38, No. 1, January 1961. (Describes a method of using bolts instead of corner register marks as employed in the Swedish Hydrographic Department.)

A NEW MAP OF MOUNT MCKINLEY, ALASKA: THE LIFE STORY OF A CARTOGRAPHIC PROJECT. Bradford Washburn. *The Geographical Review,* Vol. 51, No. 2, April 1961. (A fascinating account of the years of field work and preparation for publication of a fascinating map printed by the Swiss Federal Institute of Topography.)

Control Surveys

THE MOST PROBABLE VALUE OF A SET OF OBSERVATIONS. L. F. Gregerson. *The Canadian Surveyor,* Vol. 15, No. 6, January 1961. (Presents the idea that the most probable value, as defined, is preferable to the arithmetic mean as the accepted value of a set of observations.)

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EASTERN ROCKIES CONSERVATION AREA CONTROL SURVEY. C. W. Lester. *The Canadian Surveyor,* Vol. 15, No. 6, January 1961. (Describes Tellurometer survey in an area of Alberta with few established survey lines to enable oil exploration companies to establish drilling sites with accuracy required under the Mines and Minerals Act.)

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Property Surveys

THE CORRELATION OF TWO TRIANGULATIONS. L. A. White. *The South African Survey Journal,* Vol. 9, No. 55, Part 4, December 1960. (Offers a graphic method as an alternative and more economical method than the method of least squares.)

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TOPOGRAPHIC MAPPING BY U. S. GEOLOGICAL SURVEY AT 1: 24,000 SCALE. Harold J. McMillen. *The Canadian Surveyor,* Vol. 15, No. 6, January 1961. (Describes specifications and methods.)

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—LYMAN D. LYNN

Coast and Geodetic Survey

1962 ACSM-ASP Convention

The 1962 Joint Convention of the American Congress on Surveying and Mapping and the American Society of Photogrammetry will be held at the Shoreham Hotel, Washington, D. C., March 11–17, 1962. This will be the 22nd Annual Meeting for the ACSM and the 28th Annual Meeting for the ASP.

Granville K. Emminizer, Jr., of Ellicot City, Maryland, has been named Convention Director, and Rupert P. Southard, a resident of Fairfax, Virginia, has been named Deputy Dirctor.

Mr. Emminizer is Assistant Chief, Aeronautical Chart Division, U. S. Coast and Geodetic Survey. Mr. Southard is Acting Assistant to Chief, Office of Program Development, Topographic Division, U. S. Geological Survey.

There were over 2,400 registrants at the 1961 ASP–ACSM Convention, and more than 5,000 persons visited the government and commercial exhibits which were open to the public.

It is not too early to plan to attend the 1962 Convention.

The First State Base Line in Massachusetts for Triangulation

It is interesting to note that in 1831 the Massachusetts Legislature authorized the first State "trigonometrical", or triangulation survey.

The south end of the base line was located some four miles north of Northampton center on the west side of the Connecticut River under the direction of Simeon Borden. The line extended for 7.3882 miles in a general north direction on a fairly flat plain, ending near the village of South Deerfield. The apparatus used to measure the line "surpassed everything of the kind before used in the completeness with which it avoided and eliminated errors due to variations of temperature, etc. and in mechanical devices for convenience of manipulation". A duplicate measurement checked very closely. Corroboration of the distance by present day, wave measuring equipment would be of interest.

The angles were turned with a twelve-inch theodolite (made by Troughton and this English firm is understood to be still active) which was borrowed from the United States Coast Survey Department, now the U. S. Coast and Geodetic Survey.

Astronomical observations were made at some twenty-five locations to verify the survey. The triangulation (angles, distances, and calculations) was checked against a trial base line in the town of Attleboro and near Seekonk, in the eastern section of the State. The entire State survey was completed in 1838 and the map was published in 1842; the total cost was some $70,000.

The map was revised by H. F. Walling in 1860 under another Legislative Act, using the previous survey as a base. The base and trial lines are shown on the 1860 map and also shown in an Atlas of the State of Massachusetts by H. F. Walling and O. W. Gray, 1871.

Since the north end of the original line is in the Village of South Deerfield (famous for the Indian massacre at Bloody Brook), perhaps its location may at some time in the future be determined and a monument erected to commemorate this pioneer triangulation survey and Surveyor-Scientist. The Coast and Geodetic Survey now calls one of the triangulation stations in this vicinity, Borden.

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—A. A. SOLANDER

Distinctive Recent Maps

A world map showing *Types of Terrain* was copyrighted in 1961 by Paul V. Crawford. On the Aitoff interrupted projection, the map differentiates eight terrain types by symbolic perspective sketching patterned after the style of A. K. Lobeck and Erwin Raisz. Classification of terrain is after V. C. Finch, G. T. Trewartha, A. H. Robinson, and E. H. Hammond. The map is 14 by 24 inches and is at the scale of 1:43,000,000.

Another in the series of maps recognizing the centennial of the Civil War is a *Map of Present Richmond Showing Important Civil War Battlegrounds, Fortifications, Roads and Points of Historical Interest Within a Twenty-five Mile Area.* It was prepared for the Richmond Civil War Centennial Committee, by the Confederate Museum, the Valentine Museum, and the City of Richmond Department of Public Works. The map measures 38 by 25 inches and is at the approximate scale of 1:125,000. It is illustrated with the Union and Confederate flags and portraits of Generals Grant and Lee.

The Louisiana Geological Survey published in 1959 a *Generalized Geological Map of Louisiana.* At the approximate scale of 1:1,350,000 and measuring 16 by 17 inches, the map shows eight geological formations ranging from Upper Cretaceous to Quaternary. Compilation was directed by Leo W. Hough, State Geologist, and lithography is by A. Hoen & Company, Inc., of Baltimore, Maryland.

Aloha, a Pictorial Map of the Hawaiian Islands, the United States' Fiftieth State, is a 1960 production of Ernest Dudley Chase, gifted cartographic artist of West Harwich, Massachusetts. The map, which measures 20 by 27 inches, is decorated with a number of sketches picturing the scenic, historic, and tourist attractions of the Hawaiian Islands. Descriptive data include "Facts concerning the population," "Odd facts," "Fauna and Flora," "Brief history," "Holidays and festivals," and "Mauna Loa." There are also indexes of points of interest and post offices.

British Columbia Relief Map is an attractive and colorful physical map of Canada's Pacific Coast province. It measures 30 by 37 inches and is at the scale of 1:1,900,000. There are small-scale insets showing physiographic subdivisions and annual precipitation of the province, and a list of "Highest named mountains and some important passes."

The *Physiographic Divisions of Saskatchewan* are outlined on a map published in 1960 by the Saskatchewan Soil Survey, in cooperation with Geology Division, Saskatchewan Research Council, and Geology Department, University of Saskatchewan. It is 35 by 23 inches and is at the scale of 1:1,520,640. Physiographic and geological characteristics are summarized in a table attached to the map sheet. Nine primary regions, and some 40 or more subregions are delimited.

A new edition of the provincial map of *Brasil* was published in 1960 by the Conselho Nacional de Geografia, Instituto Brasileiro de Geografia e Estatistica. The scale is 1:5,000,000 and the dimensions are 39 by 43 inches. Provinces are distinguished by different colors. There are enlarged insets of Sudeste, Distrito Federal, and Brasilia.

Joseph A. Tosi, Jr., is the author of a recently-acquired *Mapa Ecologico del Peru.* It is at the scale of 1:1,000,000 and is printed on three sheets each of which measures 24 by 33 inches. A legend fills a fourth sheet which is about one-half as large as the map sheets. The map was compiled and published by the Instituto Interamericano de Ciencias Agricolas de la Organization de Estados Americanos, Zona Andina, Lima, Peru. The work was accomplished under Project 39 of the Programa de Cooperacion Tecnica. The map was printed in 1958 by the Instituto Geográfico Militar of Peru. Ecological data are presented in accordance with the classification of world vegetation originated by L. R. Holdridge.

Kaart van Suriname shows generalized relief, physiographic regions, towns and cities, roads, railroads, airports, ferries, airstrips and airports, and mineral deposits of the Netherland's South American colony. It was compiled by H. N. Dahlberg and published by C. Kersten & Company, Paramaribo. It measures 31 by 23 inches and is at the scale of 1: 1,000,000.

Mapa de Comunicaciones de Costa Rico shows railroads, several classes of roads, international and internal boundaries, and several categories of airports and landing strips. It is a 1960 publication of the Instituto Geografico de Costa Rica, Ministerio de Obras Publicas [San Jose, C.R.]. The map measures 21 by 25 inches and is at the approximate scale of 1:750,000.

Some fifteen formations ranging from Cretaceous to Quaternary are shown on a 1958 map of *Jamaica, Geology.* Geology is by the Geological Survey of Jamaica, and the map was drawn by the Directorate of Overseas Surveys and printed,

in 1959, by the British Ordnance Survey. The scale is 1:250,000 and the measurements are 29 by 41 inches. Copies are available from the Survey Department, Kingston, Jamaica, and Edward Stanford, Ltd. 12/14 Long Acre, London W.C. 2, England.

A 1958 map shows the major administrative subdivisions of the *People's Republic of Poland*. It was compiled under the editorial direction of H. Cytowski and published by Wydawnictw Kartograficznych, Panstwowe Przedsiebiorstwo, Warsaw. The scale is 1:1,500,000 and the map measures 19 by 23 inches.

Fiorenzo Mancini is the compiler of the *Carta dei Suoli d'Italia* (Soil Map of Italy), at the scale of 1: 1,500,000. Mr. Mancini, who is also responsible for an illustrated, descriptive booklet which accompanies the map, is Director of the Istituto di Geologia applicata dela Università degli Studi di Firenze. The booklet includes a brief English summary. "The map . . . is to be considered as the picture of the soils of Italy based on our knowledge up to December 31st, 1959. Of course the representation will be improved in the future. The soil associations are fourteen going from the alpine podzols to the mediterranean black earths. An attempt of parent materials representation was also given considering five main groups." The map measures 34 by 28 inches. It was printed at Florence (Firenze) in 1960 by Litografia Artistica Cartografica.

Sahab Geographical and Drafting Company, P.O. Box 236, Tehran, Iran, are the publishers of a 1960 *General Map of Iran*. At the scale of 1:2,250,000, it shows roads and communications, administrative divisions, and a number of towns and cities. There is also a distance table and an inset map of Bahrein Province. The map sheet measures approximately 26 by 39 inches.

A map showing *Average Annual Precipitation in Iran* was published in Tehran in 1959. It measures 15 by 16 inches and is at the approximate scale of 1:5,000,000. A note indicates that it is "a preliminary map based on all available (nonhomogeneous) data, prepared at the Iranian Meteorological Department under the supervision of Dr. M. H. Ganji (Director General) and sponsored by the Arid Zone Research Centre, Tehran University."

A new two-sheet map of *Israel* was published in 1960 by the Survey Department, Ministry of Labor. Title, names, and legend are in Israeli. The scale is 1:250,000, and each sheet measures 37 by 27 inches. Relief is indicated by color gradients, contours, and hill shading. Roads, railroads, administrative boundaries, the Armistice demarcation line, and the demilitarized zone boundary are among the cultural features shown.

Main Roads of Subtropical Africa are traced on a map published in 1959 by the Pan-African Touring Club, Grand National Buildings, Johannesburg. It extends from the Union of South Africa northward to include all of the Congo, Uganda, and Kenya. The uncolored map shows, with appropriate symbols, four classes of roads, mileages between cities and junctions, national parks, rivers, and international boundaries. It measures 45 by 32 inches and is at the scale of 1:4,000,000.

A *Communication Map of Egypt Region, U.A.R.*, at the scale of 1:500,000, is a 1960 publication of the Cairo Drafting Office, 29 Abdel Khalik Street, Cairo. Main and secondary railroads, and agricultural and macadamized roads are shown. Pictorial sketches locate archaeological sites. An index of towns and a distance table are printed on the map sheet, which measures 37 by 26 inches.

The Federal Survey Department, Nigeria, issued a reprinting in 1960 of a map entitled *Cameroons under United Kingdom Administration*. The scale is 1:1,750,000 and the measurements are 27 by 18 inches. Trust territories administered as parts of (a) Bornu, (b) Adamawa, and (c) Benue, and (d) by Southern Cameroons Government are outlined. The map also shows communication and transportation lines, towns and villages, and internal and international boundaries.

Nyasaland-Preliminary Soil Map, was complied in 1960 by Anthony Young. It measures 17 by 13 inches and is at the scale of 1:2,000,000. Fifteen different soil types are shown by color and pattern symbols. A seven-page analytical key accompanies the map. Compilation of the soil map was designed "to assist in the production of a Federal Atlas of Rhodesia and Nyasaland. It anticipates a reconnaissance soil survey of Nyasaland, on a scale of 1:250,000, which is currently in progress."

A Mineral Map of the Union of South Africa was compiled by the Geological Survey of that Dominion, and published in 1959 by the Government Printer, Pretoria. It was prepared to accompany a handbook on "The Mineral Resources of the Union of South Africa." The scale is 1:2,000,000 and the measurements are 34 by 40 inches.

Among recent accessions are two 1960 maps of Madagascar. Generalized relief of the island is presented on *Carte Physique de Madagascar*, which is at the scale of 1:2,500,000. *Carte Routiere de Madagascar* is at the scale of 1: 2,000,000. Railroads and several classes of roads are shown over a background of generalized relief shading. There is an enlarged inset of the Environs of Tananarive. Both maps were designed and published by le Service Geographi-

que a Tananarive, and printed by the Institut Geographique National of Paris.

Carte Géologique du Département de La Réunion au 50,000 is a detailed presentation of the geology of Reunion, France's island possession in the Indian Ocean, eastward of Madagascar. The map, which is on four sheets each measuring 29 by 37 inches, was compiled by Pierre Bussiere, Geologist of the Service Géologique de Madagascar. It was published under the direction of the Service de la Carte Géologique la France. Geologic formations are shown in color on a contour map base.

A *Tectonic Map of Australia,* at the scale of 1:2,534,400, is a 1960 publication of Bureau of Mineral Resources, Geology and Geophysics of Australia's Department of National Development. It was compiled by the Tectonic Map Committee, Geological Society of Australia, in cooperation with several Federal agencies. The map is printed on four sheets each measuring 33 by 39½ inches. Symbols and colors identify some 18 geologic formations ranging from Archaean to Cainozoic.

WALTER W. RISTOW

Library of Congress

Offshore Oil Well Structures Shown on Charts

The Coast and Geodetic Survey has recently published new editions of Charts 1276, 1278, and 1286 to show individual, offshore, oil-well structures along the Gulf Coast. Previous editions used broken lines to outline areas in which oil-well platforms were located. The present plan to show the locations of the individual, offshore structures was adopted in an effort to satisfy requests for more detailed coverage.

Automatic Mapping Method Patented

Hunting Survey Corporation of Toronto announced (February 1961) that U. S. patents have been issued to them covering an automatic stereoplotting device invented by Gilbert Hobrough of their Research and Development Division.

It is claimed that this is the first invention of its type to be successfully tested, proven, and patented, and represents a significant contribution to photogrammetric techniques by the application of automation to stereoperception for the production of large- and small-scale maps.

The device now patented represents some three years of research by Mr. Hobrough, and achieves automation of the basic operations of clearing parallax and driving the floating mark to produce profiles or contours automatically, as well as determining spot elevations.

Evaluation tests of the instrument by the National Research Council, Ottawa, revealed that the device measures vertical parallaxes and performs semiautomatic relative orientations more accurately than an experienced human operator. The profiling and contouring is remarkably accurate, and the speed, related to scale, is four to ten times faster than that of a human operator.

After extensive, independent, evaluation tests, the U. S. Army Map Service awarded a contract to Benson-Lehner Corporation of Los Angeles, Hunting's Licensee, for the device to be fitted to the latest Wild stereo-plotter, the B-8.

The Benson-Lehner Corporation is licensed to manufacture and sell, and plans to market under the name "Stereomat."

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Abstracts of Articles on Geodesy and Related Fields

The Army Map Service, of the Corps of Engineers, U. S. Army, publishes quarterly a series of processed sheets under the title: "Abstracts of Articles on Geodesy and Related Fields." The following are excerpts from the issue bearing the date of January 1961 and are selected for reprinting in SURVEYING AND MAPPING as being of possible interest to a considerable percentage of our readers. The selection has been somewhat arbitrary, and only those abstracts believed to be of quite general interest have been included. —EDITOR

744 *The Fourth Antarctic Expedition, Results of the First Stage of Operations* (Chetvertaya antarkticheskaya ekspeditsiya—Rezul'taty pervogo etapa rabot). A. M. Guzev

The ordinary methods of barometric leveling are not suitable in the Antarctic region because of great ice sheets. The ice sheets are producing a constant anomaly in the field of pressure of the atmosphere. Therefore, new methods had to be developed.

One of the newly developed methods, briefly described, uses an aircraft located beyond the limit of distorting pressure of the cold air layer. A considerable portion of the ice cap of Eastern Antarctica was surveyed in such a manner. The survey served as the basis for a newly constructed map, representing a general picture of the relief of that area. Other methods were used to determine elevations in the interior regions of the continent. The accuracy of the determinations is close to 50 m.

Since such an accuracy is not satisfactory for gravimetric operations, the following new method is suggested: An aircraft flies from a certain point of known elevation above sea level. Unwinding a tape proportionally to the time, the aircraft constantly records the velocity of its vertical displacement. By integration of the curve of the aircraft to the point of take-off, the absolute altitude of the aircraft is obtained. By subtracting the value obtained by the altimeter of the aircraft from its altitude, the elevation of the surface located below the aircraft is obtained. Thus, it is possible to obtain the entire profile of the area over which the flight was made.

VESTNIK AKADEMII NAUK SSSR (Russian) —AMS-Q4 V57, No. 7 (1959)-ma

752 *VÚGTK Electro-optical Distancemeter* (Elektrooptický dálkoměr VÚGTK). Borivoj Delong

The Research Institute of Geodesy, Topography and Cartography, (VÚGKT), Prague, designed and manufactured, in 1959, the first Czechoslovak electro-optical distancemeter.

A detailed description of the new distancemeter is presented.

The distancemeter serves for short distance measurements, up to 3 km., with high precision. It is a relatively simple device, mounted on a simple tripod.

GEODETICKÝ A KARTOGRAFICKÝ OBZOR (Czech) AMS-GL-B662.7200, No. 5 (1960)-ma

757 *Studies on Latitude Determinations According to Horrebow-Talcott and Sterneck with the Wild 4 Universal Instrument* (Betrachtungen ueber Breitenbestimmungen nach Horrebow-Talcott und Sterneck mit Universalinstrument Wild T 4). H. Leonhardt

An investigation is presented concerning the accuracy of latitude determinations with a Wild T 4 universal instrument according to the methods of Horrebow-Talcott and Sterneck under equal conditions.

The observations were carried out at the Geodetic Institute Potsdam and at two field stations. The results show that the internal accuracy of latitude determinations with a Wild T 4 according to Horrebow-Talcott is considerably greater than according to Sterneck.

The results obtained speak in favor of the usability of the Wild T 4 universal instrument for latitude determinations according to the Sterneck as well as the Horrebow-Talcott method.

In addition, reference is made to the results and conclusions of a dissertation by Messerschmidt in which similar studies are conducted.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350 Vol. 8, No. 6 (1960)-mc

759 *Systematics of Various Forms of Adjustment Computation* (Ueber die Systematik verschiedener Formen der Ausgleichsrechnung). Klaus Linkwitz

A comprehensive study of systematic and methodical connections between various forms of adjustment is presented, based on the papers by Bjerhammar, Gotthardt, Marchant and Tienstra.

Starting from the fundamental forms of adjustment computation, i.e. adjustment according to indirect observations and adjustment according to condition equations, all higher forms of adjustment are systematically reduced to these two fnudamental forms. This is carried out by the introduction of an extension of the concept: The weight matrix for independent observations is transformed into the general weight matrix for correlated observations, and the inverse weight matrix is transformed into the general matrix of the co-factors.

Tables are presented from which all formulae used for higher forms of adjustment can be determined together with the pertinent co-factors. These tables constitute the framework of the entire adjustment computation.

An essential aid for the formal representation is the computation by matrices. In this manner of representation—where, intentionally, no indices are used,—the methodical and systematic structure of all forms of adjustment can be clearly seen.

The quadratic and bilinear forms represent an important link for practical numerical computation. Due to the possibility of their symbolic computation, which is discussed in detail, they are not only a valuable aid for the determination of co-factors, but also for the establishment of normal equations with general weight matrices or their inverses.

A practical procedure is discussed, according to which the corrections to original independent observations can be determined inversely from the corrections to correlated observations or functions.

ZEITSCHRIFT FUER VERMESSUNGSWESEN (German) AMS-GL-B664.7001, Vol. 85, No. 5-6-7 (1960)-mc

760 *The Normal Elevations in Practice* (Die Normalhoehen in der Praxis). E. Schneider

In restoring the leveling net in the GDR, a new system of elevations was introduced, the so-called normal elevations. The normal elevation H_n of a point P on the physical surface of the earth is defined as its distance along the curved plumb line from the quasigeoid. The quasigeoid is located above the Krasovskiy ellipsoid at the distance H_Q (height of the quasigeoid).

The former German Standard Bench Mark "NH 1912" near Hoppegarten was retained. However, the reference of the elevations to the former NN orthometric elevations was replaced by the new reference to the new "zero for elevations", defined as the point where the curved plumb line meets the quasigeoid which is referred to the Kronstadt tide gauge.

The author then explains in great detail the derivation of the new formula for the computation of the differences of the normal elevations. First, there is given the equation defining the normal elevation of a point A

$$H_n^A = \frac{1}{\gamma_m{}^A} \int_0^A g\,dh$$

where: $H_n{}^A$ = normal elevation of the point A;

$\gamma_m{}^A$ = mean normal gravity along the plumb line through A;

$\int_0^A$ = the line integral along the path of integration from 0 to A;

g = measured gravity;

dh = the elevation differential.

The normal elevation for a second point B would be expressed in the same manner (but B would replace A). Then follows the original formula for the computation of the elevation difference $\Delta H_n{}^{AB}$. This formula is then transformed in several steps into a final mathematical form which, however, is simplified by the author for practical use into the form

$$\Delta H_n{}^{AB} = \Delta H_o{}^{AB} + K$$

Here, $\Delta H_n{}^{AB}$ *and* $\Delta H_o{}^{AB}$ have the same meaning as before and K designates the normal elevation correction.

K is then broken down into the two comcomponents K_1, dependent on normal gravity, and K_2 dependent on the gravity anomaly. The computation of K and K_1 and K_2 is then shown. The paper is concluded with a sample computation according to the standard printed form.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 8, No. 4 (1960)-ms.

761 *The Computation of the Geopotential*

Numbers for the German Portion of the Unified European Leveling Net (Die Berechnung der geopotentiellen Koten fuer den Deutschen Anteil am REUN). Edited by M. Kneissl.

This publication contains a collection of articles describing the work done for the selection of the loops forming the West German Portion of the REUN and the computation of the geopotential numbers.

Dr. Ing. Wernthaler discusses the criteria established for the selection of the loops and their ties with the adjacent countries. The greatest stress was laid on selecting lines in geologically stable areas, and this was considered of such importance that certain areas were avoided, such as the southern Black Forest and certain parts of the Rhineland with a great concentration of mining industry.

There follow very detailed reports on the computation of the geopotential numbers and elevation differences for the various German States: Baden-Wuerttemberg, by Prof. Ramsayer; Bavaria, Hesse and Rhineland-Palatinate, by Dipl. Ing. Boeck; and Schleswig-Holstein, Lower Saxony and North Rhine-Westphalia, by Dr. Ing. Hoepcke.

Two appendices contain the computation sheets and lists of the results.

DEUTSCHE GEODAETISCHE KOMMISSION BEI DER BAYERISCHEN AKADEMIE DER WISSENSCHAFTEN, Publs. Ser. B: Applied Geodesy No. 59 (German) AMS-GL-B664.2250 No. 59 1960-ms

762 *Cartographic Conference and Exhibit in Budapest* (Kartográfiai Konferencia és Térképészeti Kiállitás Budapesten).

The Geodetic and Cartographic Association (GKE) held its first Cartographic Conference in Budapest, October 7 through 10, 1959.

The program of the conference reviewed the status of cartography as a science, its importance in economy and defense, and the tasks and problems of Hungarian Cartography. The opening address, in the form of a historical review of cartography, was delivered by Dr. Antal Tárczy-Hornoch, President of the Association. In the name of AFTH (*Állami Földmérési és Térképészeti Hivatal* = State Office of Geodesy and Cartography) Zoltán Antos, President, greeted the Hungarian and foreign delegates. Eleven countries (Austria, Bulgaria, Czechoslovakia, Yugoslavia, China, Poland, the German Democratic Republic, the German Federal Republic, Rumania, the Soviet Union, and the United States) were represented by 52 delegates.

During the four days of the Conference a number of lectures were given. The closing session of the Conference passed four resolutions:

1. Scientific material of the lectures given at the Conference are to be published in a separate volume by the Association.

2. The recommendations presented at the Conference are to be examined by the Presidium and forwarded to those concerned.

3. The Association should schedule Cartographic Conferences at regular intervals.

4. The Association should continue to cultivate the international relations.

Simultaneously with the Conference a cartographic exhibit was open in the "House of Technology," arranged in cooperation with the ÁFTH, the Surveying Cadastral Inspectorate of Pest County (*Pestmegyei Földmérési és Földnyilvántartási Felügyelöseg*), the Cartographic Enterprise; the Budapest Geodetic and Cartographic Enterprise (*BGTV*); the Lóránd Eötvös University (*Eötvös Lóránt Tudományegyetem*); the Offset Printing Office (*Offset Nyomda*), and the National Széchenyi Library (*Országos Széchenyi Könyvtár*).

GEODÉZIA ÉS KARTOGRÁFIA (Hungarian) AMS-GL-B661.7200, Vol. 12, No. 1 (1960)

MUSZAKI ÉLET (Hungarian) AMS-T4, M21, Vol. 14, No. 22 (1959)

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 8, No. 1 (1960)

HUNGARIAN EXPORTER (English) AMS-HF37, H9H93, Vol. 10, No. 1 (Jan. 1960)-af

763 *Topographic Mapping of Hungary at 1 : 5,000 and 1 : 10,000, by Photogrammetric Methods* (Magyarorszag 1 : 5,000 es 1 : 10,000 meretaranyu topografiai terkepezese fotogrammetriai modszerrel). Geza Hanko

The territory of Hungary has been divided into three categories according to various phototopographic conditions:

1. Plain areas and rolling country, which are photogrammetrically surveyed with single photos (about 50–55% of the country).

2. Hilly areas for which the tacheometric process is recommended, combined sometimes with photo-pairs (about 20–30% of the country).

3. Mountainous areas of medium elevation, for which the stereoscopic method is preferred (about 20–25% of the country).

Aerophotographic methods are discussed, as

well as the various speeds of aircraft, the best conditions for taking pictures, the problem of itineraries, orientation during the flight, the paneling of the ground stations, and the different possibilities of selecting photogrammetric tie points, whether from the available triangulation stations, or from the detail of larger scale maps, or by means of radial triangulation.

In summarizing the photogrammetric methods from the point of view of topographic mapping, the author distinguishes three essentially different groups:

a. The photographic method, for areas where the elevation difference does not exceed ±8–10 m.

b. The graphic and mathematical method, for hilly areas, where the slopes are less than 5–6 degrees. This is a combination of the ground and aerophotogrammetric method. The "differential" method, used in the Soviet Union, is one version of this method, where the elevations are determined by the use of a stereomicrometer, multiplex, or the like. In Hungary this method is only in the experimental stage.

c. The stereoscopic ("Model") method, where the measurements are made on the reduced model of the terrain received from the photo-pairs.

A comparison is made between the accuracy obtained by ground or aerophotogrammetric survey. For the latter, the errors could reach ±0.59 and ±0.73 meters. Taking into account the graphical error, it is concluded that the stereoscopic method—even though it is the most costly—is the most universal method and is especially recommended in Hungary for areas having inclinations over 5–6 degrees.

GEODEZIA ES KARTOGRAFIA (Hungarian) AMS-GL-B661.7200, Vol. 8, Nos. 2–3 (1956)-af

772 *A Method of Determining Geographic Coordinates from Observation of Stars in the Vicinity of the Almucantar of Pole* (Wyznaczenie współrzednych geograficznych z obserwacji gwiazd w pobliżu almukantaratu bieguna). Michał Montygierd

A new method is presented concerning the determination of geographic coordinates from star observation at points of intersection of the diurnal parallel with the almucantar, touching the north pole. The method uses simplified formulae for the computation and furnishes suitable procedures for setting the instrument.

The following cases are discussed in detail: determination of latitude when the corrections of chronometer are given, determination of corrections of chronometer when latitude is given, the possibility of applying the Gauss method of determining both geographic coordinates from observations of three stars of equal altitude.

GEODEZJA I KARTOGRAFIA (Polish) AMS-GL-B676.7300, Vol. 8, No. 3 (1959)-ma

778 *Photographic Method of Observing Earth Satellites and Rockets with the Maksutov 50-cm Meniscus Telescope* (Ob organizatsii fotograficheskikh nablyudeniy sputnikov i rakety na 50-cm meniskovom teleskope Maksutova) D. A. Rozhkovskiy

The author describes a 50-cm meniscus telescope of the Maksutov type constructed at the Astrophysical Institute, Academy of Sciences of the Kazakh S. S. R. for the purpose of tracking artificial satellites. With ephemerides accurate to a few degrees, it is claimed that this apparatus is capable of still further increasing the precise determination of orbits.

The author describes the instrument in some detail. A plane-parallel glass plate is introduced which is set into an oscillating motion of 3° – 4° amplitude at the constant period of 1 second. This plate causes the images of stars and artificial objects to shift on the photographic plate. In determining the rectangular coordinates of points of the track the center between the double images of the stars is measured. The instant of time of the selected points of the track is determined directly from the chronograph tape.

ASTRONOMICHESKIY TSIRKULYAR No. 187, (Russian) L. C. S-5793–4 (1959)-ap

781 *Prospect of the Use of Optical Methods for the Establishment of Geodetic Networks* (Perspektiva primeneniya svetolokatsii dlya postroyeniya geodezicheskikh setey) V. A. Velichko

The article emphasizes the importance of using recently developed equipment for the optical measurement of distances in the USSR fundamental geodetic network. This equipment makes superfluous the measurement of conventional base lines with expansion nets. The direct measurement of an additional triangulation side in the middle of a 200 km. chain will improve the scale error by about 20 percent. The swing of the chain can be reduced by about ⅓ if an additional Laplace azimuth is

also established. Thus, the accuracy of new chains can be increased, and old chains can be strengthened by occupying only 2 or 3 stations. (The scale error of the weakest parts of the existing first-order chains is estimated to be 1/70,000 to 1/100,000).

The author suggests the establishment of control within the loops of first-order triangulation by traverses: two first-order traverses with sides 20 km. long which subdivide the area into four parts, and then a series of second-order traverses with side lengths 6–8 km. The measuring accuracy of the first order should be 0.7″ for angles and 1/150,000 for distances, for second order 1.0″ and 1/100,000 respectively.

Two types of distance-measuring instruments are now available in the U.S.S.R. to carry out such a program: the large TSNIIGAiK instrument with a precision of 1/250,000, and the medium-size SVV-1 with a precision 1/100,000. Several tens of the first type and several hundreds of the latter type would be required for the proposed program. This equipment could be produced within three years.

The article then gives the results of tests carried out in 1956–57 with optical distance-measuring instruments on three base lines, and in running three traverses through triangulation nets of first and second order. The author comes to the conclusion that the positional accuracy is equivalent to that of present triangulation requirements.

Trudy Moskovskogo Instituta Inzhenerov Geodezii, Aerofotos "Emki i Kartografii (Russian) AMS-GL-B675.2299," No. 31, (1959)-ap

784 *A Large TSNIIGAiK Optical Distance-meter* (Bol'shoi svetodal'nomer TSNIIGAiK). A. A. Genike, B. A. Larin, V. M. Nazarov, V. S. Mihailov, G. A. Fel'dman

The TSNIIGAiK designed and produced a sample of a large optical distance-meter, at the end of 1958. The instrument was designed for measuring distances up to 25 km. with an error of 1:350,000. An alternating modulation frequency was applied in the instrument.

The instrument was tested first in the area of Moscow and later on near Kirzhak, during March and June of 1959 respectively. The results are reported to be satisfactory. The accuracy obtained is almost equal to that obtained by the first-order triangulation.

A detailed description of the instrument is also presented.

Geodeziya i Kartografiya (Russian) AMS-GL-B675.2214, No. 10 (1959)-ma

T. B. M.

During a field conference, which took place over the hood of my car, a power-company engineer asked a puzzling question as to why a certain one of their poles had to be moved. The conference concerned moving and relocating power lines in a town that will be flooded by the construction of a dam. The pole about which he inquired was a new one which was outside the area to be disturbed. After replying in the negative, I inquired as to why he asked. He replied, "One of your people nailed a stake on it which said 'TBM'. That means 'to be moved' doesn't it?"

The above was contributed by an ACSM member, but, for reasons that should be rather obvious, we have decided to omit all reference to names and places. —Editor

A Tractor With the Wheels on Top

A remote-control, underwater tractor to pull scientific equipment beneath the ice of Madison's Lake Mendota is being designed at the University of Wisconsin. Professor Donald Livermore, director of the project, says the machine will ride on the undersurface of the ice, be controlled by sound impulses, and carry a small radioactive source by which scientists will track its movements. An experimental model of the tractor was tested late last winter, but, because ice conditions exist for only one to three months a year, perfection of the device may be a year or two away.

The tractor is an airtight, aluminum box, 4 feet long by 14 inches square, which carries an electric motor and batteries, and rides on two, air-filled, spiked wheels and a sledrunner. The tractor's body floats, pressing the wheels against the undersurface of the ice. A hydrophone extending from the tractor senses sound impulses sent by the researchers and sets off switching devices which start, stop, and steer the tractor. The tractor will operate at speeds of one-half to two miles per hour for four hours without recharging the battery.

Map Information

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published or became available for distribution by the U. S. Geological Survey between December 1, 1960 and February 28, 1961. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged, but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or without the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown—except those marked with the letter (P), which are planimetric); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, townships and section lines are shown. The State rectangular coordinate and the UTM 1,000-meter grid systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C., (or Denver 15, Colorado, for maps of areas west of the Mississippi River).

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* Indicates 15-minute quadrangles; all others are 7½-minute quadrangles.
[1] Indicates a revised map.
[2] Indicates a series-converted map.
† Indicates availability in either a contour or a shaded-relief edition.
‡ Indicates preliminary black and white edition.

Alabama

ANNISTON[1]—Calhoun
BESSEMER—Jefferson
BIRMINGHAM NORTH—Jefferson
COLVIN GAP[2]—Etowah
EULATON[1]—Calhoun
GLENCOE[1]—Etowah
HYATT GAP—St. Clair
JACKSONVILLE[1]—Calhoun
KEENER—Etowah
MUNFORD[1]—Talladega
OXFORD[1]—Calhoun
RODENTOWN—De Kalb
WELLINGTON[1]—Calhoun

Alaska

MOUNT HAYES B-6*
NORTON BAY A-2*
NORTON BAY B-2*
NORTON BAY C-2*
NORTON BAY D-2*
PRINCE RUPERT D-1*
PRINCE RUPERT D-2*
RUSSIAN MISSION C-1*
RUSSIAN MISSION C-2*
RUSSIAN MISSION C-3*
RUSSIAN MISSION D-1*
RUSSIAN MISSION D-2*
RUSSIAN MISSION D-3*
TALKEETNA B-1*

Arizona

TORTOLITA MTNS.*—Pinal

Arizona-Nevada

BLACK CANYON*—Clark
MT. PERKINS*—Mohave

Arkansas

MADISON—St. Francis
SELDGWICK*—Lawrence
WEINER*—Poinsett

California
ARROYO TAPIADO—San Diego
BORREGO PALM CANYON—San Diego
CANNIBAL ISLAND—Humboldt
CARRIZO MOUNTAIN*[2]—Imperial
CASMALIA—Santa Barbara
CONDOR PEAK—Los Angeles
FONTS POINT—San Diego
FORTUNA—Humboldt
GLENBLAIR*—Mendocino
HARPER CANYON—San Diego
IDYLLWILD*—Riverside
IN-KO-PAH GORGE—Imperial
KELSEYVILLE—Lake
KERNVILLE*—Kern
KNOXVILLE—Napa
LAS BOLSAS*—Orange
LOS ALAMOS—Santa Barbara
LOS GATOS*—Santa Clara
LUCERNE—Lake
MIDWAY WELL*[2]—Imperial
MONUMENT PEAK—San Diego
ORCUTT—Santa Barbara
PALM DESERT*—Riverside
POINT SAL*[2]—Santa Barbara
RUMSEY—Yolo
SAN MARCOS PASS—Santa Barbara
SANTA ROSA HILLS—Santa Barbara
SOMBRERO PEAK—San Diego
TIERRA DEL SOL—San Diego
TWITCHELL DAM—Santa Barbara
UKIAH*[2]—Mendocino

Colorado
BOULDER*[2]—Boulder

Connecticut
BOTSFORD[1]—Fairfield

Florida
BEVERLY BEACH—Flagler
DINNER ISLAND—St. John
LAKE LOUISA SW—Polk
LAKE NELLIE—Lake

Georgia
WAVERLY—Camden

Hawaii
MOKAPU[1]—Honolulu

Idaho
CROWS NEST*—Owyhee

Illinois
WINNEBAGO—Winnebago

Indiana
ASHLEY[1]—De Kalb
ATWOOD—Kosciusko
Beech Grove[1]—Marion
BRAZIL EAST[1]—Clay
BRAZIL WEST[1]—Clay
CARMEL[1]—Hamilton
CARTHAGE—Rush
CLERMONT[1]—Marion
FISHERS[1]—Hamilton
GALVESTON—Cass
GILMAN—Madison
HAMILTON[1]—Steuben
HIGHLAND[1]—Lake
KNIGHTSTOWN—Henry
MANILLA—Rush
MIDDLETOWN—Henry
NORTH JUDSON—Starke
SAN PIERRE—Starke
VALLEY FALLS[1]—Jefferson
WADESVILLE—Posey
WOLCOTTVILLE[1]—Lagrange

Iowa
MASON CITY—Cerro Gordo

Kansas
BERN—Nemaha
HALF MOUND—Jefferson
HOLTON SE—Jefferson
HORTON NW—Brown
MORRILL—Brown
NORTONVILLE—Jefferson
POTTER—Atchison
VALLEY FALLS—Jefferson
WINCHESTER—Jefferson

Kentucky
LEXINGTON WEST[1]—Fayette
VALLEY STATION[1]—Jefferson

Louisiana
BOUDREAUX LAKE—Cameron
BROWNS LAKE—Cameron
CENTERVILLE*[1]—St. Mary
DONALDSVILLE*—Ascension
FIVE LAKES—Cameron
LAKE CHICOT*[1]—St. Martin
MARINGOUIN*—Iberville

Maine
CHESUNCOOK*—Piscataquis
FREEPORT*[1]—Cumberland

Maine-New Hampshire
BERWICK*[1]—York
SOMERSWORTH[1]—Strafford

Massachusetts-New York
PITTSFIELD WEST[1]—Berkshire

Michigan
CUSTER*—Mason
EAST TAWAS*—Iosco
GLENNIE*—Alcona
HARRISVILLE*—Alcona
HART*—Oceana
HILLSDALE—Hillsdale
LAKE*—Clare
LUDINGTON*—Mason
TAWAS CITY*—Iosco
WHITE CLOUD*—Newaygo

Minnesota
DERTOIT LAKES—Becker
FLAT LAKE—Becker
HEIGHT OF LAND LAKE—Becker
LOWER WHITEFISH LAKE—Crow Wing
PELICAN LAKE—Crow Wing
RICHWOOD—Becker
ROCHERT—Becker
THIEF RIVER FALLS—Pennington
TOAD MOUNTAIN—Becker
TROMMALD—Crow Wing

Mississippi-Tennessee
HERNANDO*—De Soto

Missouri
DE SOTO[1]—Jefferson
GALLOWAY—Greene
GOSS—Monroe
STOUTSVILLE—Monroe
VINELAND[1]—Jefferson

Montana
GRANT*—Beaverhead
POLARIS*—Beaverhead

Nevada
BOULDER CITY*[2]—Clark
GIROUX WASH—White Pine
RUTH—White Pine

Nevada-Idaho
ELK MOUNTAIN*—Elko

New Hampshire
OSSIPEE LAKE*[1]—Carroll

New Mexico
ARROYO CUERVO—Doña Ana
ELEPHANT BUTTE—Sierra
HATCH—Doña Ana
LEMITAR—Socorro
MAGDALENA*—Socorro
MESA DEL YESO—Socorro
SIERRA ALTA—Doña Ana
SOCORRO—Socorro
SOUSE SPRINGS—Doña Ana
STEEPLE ROCK*—Grant
UPHAM*—Sierra

New York
ADAMS—Jefferson
BARNES CORNERS—Lewis
BARNHART ISLAND—St. Lawrence
CAMDEN WEST—Oneida
CAPE VINCENT NORTH—Jefferson
CHASE MILLS—St. Lawrence
HENDERSON—Jefferson
HENDERSON BAY—Jefferson
HOBART—Delaware
MASSENA—St. Lawrence
MURPHY ISLAND—St. Lawrence
NORFOLK—St. Lawrence
PANTHER LAKE—Oswego
PARISHVILLE—St. Lawrence
POTSDAM—St. Lawrence
RODMAN—Jefferson
ROXBURY—Delaware
RUTLAND CENTER—Jefferson
SACKETTS HARBOR—Jefferson
SYRACUSE WEST[1]—Opondaga
TREADWELL—Delaware

New York-Connecticut
PEACH LAKE[1]—Westchester

North Carolina
LAKE LURE*—Rutherford
ROSEBORO*—Sampson

North Carolina-Tennessee
BALDWIN GAP—Ashe

North Carolina-Virginia
PARK—Grayson

North Dakota
GRAFTON—Walsh
KINDRED—Cass
LEONARD—Cass
MARMON SE—Williams
McCLUSKY—Sheridan
MERCER—McLean
MERCER SE—Burleigh
MERCER SW—Burleigh
MOORETON NW—Richland
OAKWOOD—Walsh
PICKARDVILLE—Sheridan
WILLISTON EAST—Williams
WILLISTON WEST—Williams
WYNDMERE NE—Richland

North Dakota-Minnesota
BIG WOODS NW—Walsh

Ohio
ARCHBOLD—Fulton
BERLIN HEIGHTS—Erie
DEFIANCE EAST—Defiance
DORSET—Ashtabula
FLORIDA—Henry
KIMBALL—Erie
KIPTON—Lorain
MILAN—Erie
NAPOLEON WEST—Defiance
PORT CLINTON—Ottawa
RIDGEVILLE CORNERS—Henry

Ohio-Pennsylvania
LEON—Ashtabula

Oregon
BROKEN TOP*—Deschutes
GERBER RESERVOIR*—Klamath
LAWEN*—Harney
THREE SISTERS*—Lane

Pennsylvania
ALBION—Erie
AUGHWICK—Huntingdon
BEAVER CENTER—Crawford
CANONSBURG[1]—Washington

CURWENSVILLE—Clearfield
DEVILS ELBOW—Clearfield
EAST SPRINGFIELD—Erie
LESCONTES MILLS—Clearfield
LINESVILLE—Crawford
LUTHERSBURG—Clearfield
MOUNT UNION—Huntingdon
NEWTON HAMILTON—Mifflin
PENFIELD—Clearfield
REWARD—Perry
SABULA—Clearfield
SANDY RIDGE—Centre
THE KNOB—Clearfield

Puerto Rico
BAYANEY[1]—Hatillo

South Carolina
BEAUFORT—Beaufort
JASPER—Jasper
LEGAREVILLE—Charleston

South Dakota
FAIRPOINT—Meade

Tennessee
BUMPUS MILLS[1]—Stewart
WOODLAWN[1]—Montgomery

Texas
CEDAR HILL—Dallas
CONROE NE—San Jacinto
DUNCANVILLE—Dallas
EULESS—Tarrant
LAKE TRAVIS*—Travis
SPENCER LAKE—Donley
TROUBLESOME CREEK—Donley

Utah-Idaho
KELTON PASS*—Box Elder

Virginia
ASHBY GAP—Clarke
ATKINS—Smyth
KONNAROCK—Washington
MIDDLE FOX CREEK—Grayson
TROUT DALE—Grayson
UPPERVILLE—Fauquier
WHITETOP MTN—Smyth

Washington
STELLACOOM[1]—Pierce

West Virginia
CUZZART—Preston

West Virginia-Pennsylvania
BETHANY—Brooke
BRANDONVILLE—Preston
VALLEY GROVE—Marshall

Wisconsin
COLOMA* (P)—Waushara
HALES CORNERS*[2]—Milwaukee
HALES CORNERS—Milwaukee
HARTFORD*—Washington
MUSKEGO—Waukesha
NORTH CAPE—Racine
PORT WASHINGTON EAST—Ozaukee
RICHWOOD—Dodge
WATERFORD—Racine
WAUTOMA* (P)—Waushara
WEST BEND*—Washington

Wyoming
BARLOW GAP—Natrona
BEULAH BELLE LAKE—Natrona
BLACKJACK RANCH—Natrona
BROAD MESA—Natrona
EIGHTMILE DRAW—Natrona
GARFIELD PEAK—Natrona
GAYLORD RESERVOIR—Natrona
HORSE CREEK SPRINGS—Natrona
McRAE GAP—Natrona
MILLER SPRING—Natrona
SADDLE ROCK—Natrona
STINKING WATER CREEK—Natrona

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the 50 United States and Puerto Rico are being published and distributed. They may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Alaska
DIXON ENTRANCE†
UNALAKLEET†

Arizona
PRESCOTT

Arizona-Nevada-California
KINGMAN

California
REDDING
UKIAH

Colorado
MONTROSE

Florida
APPALACHICOLA

Idaho-Montana
ELK CITY
WALLACE

Kansas-Missouri
LAWRENCE

Maine
MILLINOCKET

Maine-Quebec
PRESQUE ISLE

Montana-Idaho
HAMILTON

Special metropolitan and vicinity maps of major United States cities are being published and distributed by the Geological Survey. These maps are prepared from standard 7½-minute maps at the scale of 1:24,000. Vicinity maps may be purchased from the Geological Survey for the prices indicated below.

NEW YORK AND VICINITY, (HEMPSTEAD, NEW YORK). (39 by 54 inches) $1.50.
NEW YORK AND VICINITY, (PATERSON, NEW JERSEY-NEW YORK). (39 by 54 inches) $1.50.
NEW YORK AND VICINITY, (STATEN ISLAND, NEW YORK-NEW JERSEY). (39 by 54 inches) $1.50.

The following National Park Maps are now available.

SCOTTS BLUFF NATIONAL MOUNUMENT.† (17 by 21 inches) 1:15,840. $0.30.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit, Michigan, at $1.00 per copy. Payment is required in advance by P. O. money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

42.—Lake St. Clair. Entire lake, including St. Clair River to Woodtick Island, at 1:60,000 scale. Inset on reverse side: Mouth of the Clinton River, at 1:15,000 scale, showing entrance in sufficient detail for navigation of small boats.

723.—Lake Michigan. Menominee Harbor, Michigan, and Marinette Harbor, Wisconsin, at 1:15,000 scale.

774.—Lake Michigan. Ludington, Michigan, and Pere Marquette Lake, at 1:5,000 scale.

776.—Lake Michigan, Manistee, and Manistee Lake, Michigan, at 1:10,000 scale.

777.—Lake Michigan. Portage Lake, Michigan, at 1:10,000 scale.

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between December 1, 1960 and February 28, 1961. The class and purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D.C.

Alaska

U. S. Survey No. 3061-B, No. Add. Anchorage Townsite
U. S. Survey No. 3703 Recreation and Public Purpose tract, Revillagigedo Island
U. S. Survey No. 3806 (computed) Forest Elimination

Arizona—Gila and Salt River Meridian

T. 41 N., R. 9 E., Page Townsite subdivisions (7)
T. 2 S., R. 23 W., Dependent resurvey—part
T. 11 S., R. 25 W., Dependent resurvey—part

California—Humboldt Meridian

T. 7 N., R. 3 E., Dependent resurvey—part
T. 8 N., R. 3 E., Dependent resurvey—part
T. 7 N., R. 3 E., Dependent resurvey—part
T. 8 N., R. 4 E., Extension survey

California—Mount Diablo Meridian

T. 32 N., R. 6 W., Dependent resurvey—part
T. 31 N., R. 9 W., Dependent resurvey—part
T. 32 N., R. 9 W., Dependent resurvey—part
T. 11 S., R. 26 E., Dependent resurvey—part

California—San Bernardino Meridian

T. 8 N., R. 1 E., Dependent resurvey—part
T. 8 N., R. 1 W., Dependent resurvey—part
T. 6 N., R. 3 W., Resurvey and subdivisional
T. 7 N., R. 4 W., Dependent resurvey—part
T. 2 N., R. 26 E., Resurvey and subdivisional

Montana—Principal Meridian

T. 5 N., R. 12 W., Dependent resurvey—part

New Mexico—New Mexico Principal Meridian

T. 20 N., R. 9 E., Dependent resurvey—part
T. 14 N., R. 9 W., Dependent resurvey—part
T. 21 S., R. 29 E., Dependent resurvey—part

North Dakota—Fifth Principal Meridian

T. 150 N., R. 64 W., Dependent resurvey—part
T. 151 N., R. 64 W., Dependent resurvey—part
T. 152 N., R. 64 W., Dependent resurvey—part
T. 151 N., R. 65 W., Dependent resurvey—part
T. 152 N., R. 65 W., Dependent resurvey—part

Oregon—Willamette Meridian

T. 29 S., R. 7 W., Dependent resurvey—part
T. 27 S., R. 12 W., Resurvey and subdivisional
T. 40 S., R. 13 W., Resurvey and subdivisional
T. 40 S., R. 1 E., Resurvey and subdivisional
T. 5 S., R. 4 E., Resurvey and subdivisional
T. 35 S., R. 12 E., Survey of Piaute Cemetery

Utah—Salt Lake Meridian

T. 41 S., R. 6 W., Skeleton Survey
T. 24 S., R. 8 W., Skeleton Survey
T. 42 S., R. 8 W., Skeleton Survey
T. 42 S., R. 9½ W., Skeleton Survey
T. 20 S., R. 10 W., Skeleton Survey
T. 21 S., R. 10 W., Skeleton Survey
T. 22 S., R. 10 W., Skeleton Survey
T. 23 S., R. 10 W., Skeleton Survey
T. 24 S., R. 10 W., Skeleton Survey
T. 42 S., R. 10 W., Skeleton Survey
T. 20 S., R. 11 W., Skeleton Survey
T. 21 S., R. 11 W., Skeleton Survey
T. 22 S., R. 11 W., Skeleton Survey
T. 23 S., R. 11 W., Skeleton Survey
T. 24 S., R. 11 W., Skeleton Survey
T. 16 S., R. 12 W., Skeleton Survey
T. 17 S., R. 12 W., Skeleton Survey
T. 20 S., R. 12 W., Skeleton Survey
T. 21 S., R. 12 W., Skeleton Survey
T. 22 S., R. 12 W., Skeleton Survey
T. 23 S., R. 12 W., Skeleton Survey
T. 24 S., R. 12 W., Skeleton Survey
T. 25 S., R. 12 W., Skeleton Survey
T. 15½ S., R. 13 W., Skeleton Survey
T. 16 S., R. 13 W., Skeleton Survey
T. 17 S., R. 13 W., Skeleton Survey
T. 18 S., R. 13 W., Skeleton Survey
T. 19 S., R. 13 W., Skeleton Survey
T. 20 S., R. 13 W., Skeleton Survey
T. 15½ S., R. 14 W., Skeleton Survey
T. 16 S., R. 14 W., Skeleton Survey
T. 17 S., R. 14 W., Skeleton Survey
T. 18 S., R. 14 W., Skeleton Survey
T. 19 S., R. 14 W., Skeleton Survey
T. 20 S., R. 14 W., Skeleton Survey

Wisconsin—Fourth Principal Meridian

T. 38 N., R. 9 E., Survey of omitted lands—sec. 35

Wyoming—Sixth Principal Meridian

T. 53 N., R. 91 W., Dependent resurvey
T. 53 N., R. 92 W., Dependent resurvey

County General Highway Maps

THE FOLLOWING county general highway maps were received by the U. S. Bureau of Public Roads, Washington, D. C. during the period from December 1, 1960, to February 28, 1961. Copies of these maps are sent to the Washington office as part of the continuing cooperative Federal-State highway planning program, as they are compiled or revised by the State highway departments.

Inquiries concerning prices, and orders should be sent to the respective State highway departments and not to the U. S. Bureau of Public Roads.

Alabama
ETOWAH
FAYETTE
MARSHALL
WINSTON

Arizona
GILA
SANTA CRUZ

Colorado
MOFFAT
SUMMIT

Florida
PASCO

Georgia
BIBB
BRANTLEY
BURKE
BUTTS
CHATTAHOOCHEE
CLAYTON
DOOLY
EFFINGHAM
GLASCOCK
HARALSON
HEARD
HENRY
PEACH
PULASKI
SCHLEY
SCREVEN
SPALDING
SUMTER
TAYLOR

UNION
WHITFIELD

Indiana
BLACKFORD
BOONE
HAMILTON
HENRY
JAY
STEUBEN
VANDERBURG

Kansas
CLARK
ELLSWORTH
HODGEMAN
JACKSON
NESS
SEDGWICK
SHERMAN

Louisiana
ASCENSION
LA SALLE
TENSAS

Michigan
CHIPPEWA
LUCE
MACKINAC
SCHOOLCRAFT

Minnesota
ANOKA

Mississippi
ATTALA
CARROLL
ISSAQUENA
NESHOBA
WINSTON

Nebraska
BOX BUTTE
MORRILL
SCOTTS BLUFF

Nevada
HUMBOLDT

North Carolina
CHOWAN
HYDE
PAMLICO
PERQUIMANS
PASQUOTANK

North Dakota
GRAND FORKS
McLEAN
RICHLAND
SARGENT
STEELE

Oregon
JEFFERSON
WHEELER

Pennsylvania
LEBANON
LEHIGH
NORTHAMPTON
PERRY
WESTMORELAND

South Dakota
BON HOMME
CHARLES MIX
LINCOLN

Tennessee
CLAY
DE KALB
JACKSON
MARION
SEQUATCHIE

Utah
SALT LAKE

New Type of Globe

A unique world globe with a "thinking cap" has been produced by the National Geographic Society. The Society's cartographers abandoned the traditional axis rod to permit the sphere to be moved freely in a special stand.

Removal of the fixed axis offers several advantages. Any spot on earth, particularly the polar regions, can be spun into a convenient position for viewing. Mileage, time differences, and shortest routes between any two points can be measured quickly by lining them up on the graduated rim of the stand.

The globe is equipped with a plastic geometer that fits over the top of it and can be put on or taken off like a cap. Embossed on the under side of the transparent surface are useful scales.

With the trio—sphere, cradle, and geometer—a user of the globe can obtain a variety of facts. He can, for example, plot satellite orbits, estimate the size of any country, figure compass headings on great-circle routes, compute the sun's position anywhere at any time, and compare the shapes and sizes of land masses. The globe can be used with the National Geographic Society's Map of the Heavens to locate the positions of stars and other celestial bodies for any day and hour during the year.

Status of Aerial Photography

The 1961 edition of the index "Status of Aerial Photography" is now available on request to the U. S. Geological Survey, Washington 25, D. C., or Denver 25, Colorado.

This index presents an inventory of areas of the United States known to have been photographed by or for Federal, State, or commercial agencies. For those areas photographed more than once for special purposes, the coverage considered most suitable for average needs is shown as primary photography. The agencies from which reproductions of this photography may be obtained are indicated by color patterns.

Totem Pole for C&GS Seattle Ship Base

From the *Personnel Panorama,* March 1961, we learn that Tom Ukas, a 72-year-old totem carver, may well be remembered as the creator of the last authentic totem pole to come from Alaska. Working in a tiny, lean-to shack on the shore of Wrangell Harbor, he is carving a Thunderbird totem for the Coast and Geodetic Survey. The work is being done under the sponsorship of the Wrangell Chamber of Commerce. When completed the pole will be placed at the entrance to the Coast and Geodetic Survey Ship Base at Seattle, Washington, as a symbol of the good will between the Coast and Geodetic Survey and the State of Alaska. The Survey, through its mapping and charting activities in Alaska, has played an important part in the development of that portion of the North American Continent which has recently emerged as the State of Alaska.

Comment and Discussion

The pages of SURVEYING AND MAPPING are open to free and temperate discussion of all matters pertaining to the interests of the Congress. It is the purpose of this department to encourage comments on published material or the presentation of new ideas in an informal way. —EDITOR

CONGRESS AFFAIRS

GEORGE C. BESTOR[1]—I am extremely pleased at your appointment of a committee under the chairmanship of John McAlinden[2] to study the problem of the dues structure of the ACSM. The crictical lack of funds for needed activities was a situation I constantly faced during my term as president in 1959.

Examination of the 1960 financial statement[3] of the Congress shows that the current dues miss by a few cents a year per member of paying for the Journal and for the headquarters costs of handling subscriptions and memberships. Even this is only possible because of the dedicated service of our headquarters officers, who each give ten to twenty hours a week of their time for a token honorarium which scarcely covers their lunches and taxi fares. This is not right, nor is it a safe basis of operation, for a society of 6,000 members. Furthermore, I consider it wrong that budgets for Division activities, travel of officers to Sections and Affiliates, and all the other urgently needed professional and association activities should be limited to amounts coming in from such fringe sources as annual meetings, interest on invested funds, etc.

I therefore urge that this new committee, in examining the dues structure, approach the matter from the viewpoint of "what do the surveyors, mappers, geodesists, and educators in our field need in the way of service from the ACSM?" I do not advocate going overboard, but I do believe that most surveyors are ready to pay for required services to the profession. For every man who will drop out because of a dues raise, I am convinced we will soon pick up several new members who will be attracted by the increased activities. Wonderful as they are, the Journal and the Annual Meetings should not be the total substance of the ACSM. That is, I am sure, the feeling here in the West and I believe elsewhere.

Congratulations on taking a step which has long been needed. The ACSM has just had its 21st birthday, and is like a youth who has shot up to size but needs to build muscle. One form of muscle needed in all society activities is money. I earnestly urge that your committee take resolute steps toward a proper dues structure, so that needed steps may be taken which have long been held off through financial necessity.

[1] Mr. Bestor's letter was addressed to Brother B. Austin Barry, President, ACSM.

[2] A statement concerning the "McAlinden Committee" will be found on page . . of this issue of SURVEYING AND MAPPING.

[3] *See* SURVEYING AND MAPPING, March 1961, Vol. XXI, No. 1, page 131.

MARYLAND COUNTY BOUNDARY

JOHN V. MILLER, M.D.*—In response to the problem posed in the current (March 1961) issue of SURVEYING AND MAPPING at page 77, "Maryland County Boundary in Doubt," I do not know what has been done with the problem previously, but I should like to propose a possible approach, which, if it has not been tried previosuly, might help to solve the problem.

It would seem to me that the first approach should be to find the plantation of Seth Hyatt. I am not familiar with the Maryland Hall of Records at Annapolis, but from experience in its Pennsylvania counterpart, the Bureau of Land Records at Harrisburg, no doubt original surveys of Hyatt's plantation are on record there. If such a survey can be found it would be of interest to learn if any of its corners are recognizable on aerial photographs of that area which are undoubtedly available.

I am enclosing photostatic copies of two surveys made by Zack Butcher in 1735, and an aerial photograph made for Soil Conservation Service on 22 September 1937. I believe you will agree with me that there can be no doubt

* P. O. Box 434, Dillsburg, Pa.

as to the location of William Walker's and James Saw's plantations. Incidentally, I should appreciate your returning the prints.

Perhaps this method has been attempted by the counties involved, but I could not resist the temptation to write you about it.

EDITOR'S NOTE.—We were at first mildly surprised that a medical man should have picked up the item referred to in the March 1961 issue of SURVEYING AND MAPPING. However, it develops that Dr. Miller has been a member of the ACSM for quite a number of years. The photostat copies of the two surveys to which Dr. Miller refers would not reproduce well on the pages of SURVEYING AND MAPPING, and the reproduction of the aerial photograph without the corresponding plats would serve no useful purpose. These documents have been returned to Dr. Miller. The fact remains, however, that it took your editor less than five minutes to spot the two plantations on the aerial photograph, despite the fact that his experience in reading such photographs is practically nil.

PROFESSIONAL, SUBPROFESSIONAL, AND NONPROFESSIONAL

W. S. DIX*—Recent and current issues of SURVEYING AND MAPPING have been seriously concerned with the *status* of surveying and mapping—especially as to the *professional, preprofessional,* and *technician* differentiations.

In all probability, this issue of the ACSM Journal will carry resolutions from the annual meeting which upon analysis will show that *skilled* and *unskilled* labor are also sensitive to the full scope of surveying and mapping employment.

May I, therefore, seriously suggest reflection on comparisons and analyses with careful consideration to the real classifications involved—*professional, subprofessional,* and *nonprofessional.*

* PE&LS; Executive Secretary, ACSM; Vice President, ACSM, etc.

THE PROFESSIONAL STATUS OF LAND SURVEYORS

TRACY B. SLACK*—I write in answer to Curtis M. Brown's article appearing in the March (1960) issue of the Quarterly Journal of the American Congress on Surveying and Mapping, "The Professional Status of Land Surveyors."

While I must assume that Mr. Brown's desire is to "Lift up the fallen (or falling)" I am considerably irked by his opening remarks which include: "First, he can have subprofessional standing with low educational requirements and minor areas of practice, or second, he can bring himself up to the standards of the *better professions* (italics mine) and assert himself in a larger area of practice."

In his paragraph which begins "Without doubt the *educators* are the most severe critics of our reputation, and their criticism has *justifiable merit,*" I say "*Merit* be hanged!" since engineering professors have failed miserably to teach land surveying properly and by contrast have graded land surveying down and sometimes out. Mr. Brown moralizes with regard to low fees on the one hand and working as a public-spirited citizen with less regard to fees on the other.

I deduce from Mr. Brown's reference to a "better profession" an apology for the land surveyor, suggesting that a land surveyor is in some sort of competition with a doctor, lawyer, clergyman, or perhaps a civil engineer!

I do not hold with the idea that the American Society of Civil Engineers is altogether capable of deciding whether land surveying is or is not a branch of civil engineering. Their wavering tactics suggest a fear for the security of their own positions. Their attitude smacks of the old bromides about "being careful of the company you keep," "one cannot be too careful," etc. Another conclusion to be drawn is smugness. A pity.

The engineering schools have little more to offer as "educational requirements" to a student in land surveying than the mechanics they offer the student of civil engineering. During my forty years as a practicing land surveyor (and somewhat of a civil engineer) I have seen but one major effort as *text* for the land surveyor, and that from the pen of Mr. Brown and his coauthor Fred H. Landgraf, though I do not take lightly my T. Baker, C.E.'s "Land & Engineering Surveying," published in London. I gather that a land surveyor would be accepted if he should emerge as somewhat-of-a-civil-engineer, or, in other words, "Can't we dress him up in some sort of way so that he will look good enough not to embarrass the

* Civil Engineer, Administration, Department of Natural Resources, Commonwealth of Massachusetts; Registered Land Surveyor, Massachusetts and Connecticut; Member, Boston Society of Civil Engineers; and Member, American Congress on Surveying and Mapping. Mr. Slack resides at 177 Montague Road, North Amherst, Massachusetts.

civil engineering profession which has rather hestitantly included land surveying as a branch of civil engineering?"

That "professional stature cannot be attained by self proclamation" is another fallacy. If a land surveyor has a complex about "being left behind," would this not parallel the seeming complex of the dentist who refers to himself as "doctor?" It is true that it is too easy in some States to practice or register as a land surveyor and a great deal of harm is done permanently to both the profession and to land records. I also fail to grasp Mr. Brown's concern as to "What others think of us" since, if we feel secure in our skills and integrity, we have "professional stature."

There are many new, fascinating, mechanical devices—all the way from photogrammetry to license numbers on monuments—suggested as ways of improving the *grade* of a land surveyor. I contend that these new and revolutionary methods available to the land surveyor are important mechanical devices, but nevertheless to a great extent as much an affectation as the would-be orator's use of high-flown language, when he would do well to emulate one W. S. Churchill. Contemporaries have been exercising their mechanical skills for years; setting beautifully monumented, exceptionally well closed, and artistically delineated property plans, where property bounds do not now, nor never did, exist. I still find myself hypnotized by these things.

Appropriate to the seeming thread of a combination of sincere alarm, apology, a few homiletics about fees, work for the greater glory—regardless of fees, ethics, behavior, etc., and a complex about the land surveyor's "professional stature" that runs through Mr. Brown's undoubtedly dedicated article, I am reminded of the saying "He who pleads his own case has a fool for a client" and another about the native of ancient Scotland, a chieftain, who arrived at the banquet late and sat in the nearest chair he could find, whereupon a nervous flunkey whispered "Mr. MacGregor, you're supposed to sit at the *head* of the table," at which MacGregor boomed out "WHEREVER MACGREGOR SITS IS THE HEAD OF THE TABLE!" "Professional stature" is attained through achievement and pride in a demand for one's skills.

I contend that the correction lies not in these window-dressing attempts and homiletics that tend to show a need of pulling ourselves up by our bootstraps, but in the need of real land surveying courses taught by accomplished land surveyors who have no complexes about how they would grade as civil engineers, and these courses augmented by a thorough course in all that a land surveyor (and a civil engineer) should know about real estate law and conveyancing, to be taught by eminent real estate attorneys who, again, have no complexes about real estate law as opposed to more remunerative civil and criminal cases.

I do not prescribe the above through any complex about "professional stature" but to correct the thesis that land surveying is second-rate civil engineering—that did the practicing land surveyor have degrees in civil engineering there would be no question about his work, regardless of how little he knew about land surveying. Therein lies the whole fallacy, for many civil engineers and land surveyors have a wholesome respect for what they do not know about the other's field. The first-rate land surveyor is a superior person who is ethical and has the intelligence to appreciate the importance of his role as sometimes judge and jury—acting for both his client and the "adjoiner." So many times not dishonesty but ignorance, that may prevail despite a college degree, can account for much poor handling of boundary or property problems. These are quite distinct from the problems that attend the mechanics of the purely technical questions which call for more of a "pattern treatment" than the accumulated resourcefulness of an experienced practicing land surveyor. The so-called "woodlot surveyor," whose experience and interpretive abilities are quite superior, is apt to have a complex about these elusive mechanics a little out of his reach, while in reality he should command a wholesome respect for his basic knowledge of land surveying. Just as the medical "specialist" who looks down his nose at the "general practitioner" who plugs away at the homely ailments that may be less spectacular but equally vital, so does the land surveyor plug away at the solution of properties problems that are less spectacular and less remunerative than the more purely technical problems that confront the specializing civil engineer.

Excepting forestry schools, which treat the subject earnestly, if inadequately, there do not seem to be any solid courses in land surveying taught anywhere, currently.

With due respect for the need to examine and employ existing and improved land surveying mechanics, I submit there are no more important attributes than that a land surveyor faithfully *interpret*, faithfully establish or reestablish and record property monuments without prejudice. An important mechanical feature of land surveying, much neglected, is the establishment of con-

trols, if previously established grids and benches are not economically available.

I have attempted to point out that it is both futile and meaningless to try to equate professions since their importance must derive from a demand and an achievement resulting from the exercise of separate and varying skills.

It should be added that the moral and ethical code prescribed by Mr. Brown should be the *usual pattern* for all men in all endeavor.

Editory Yell

Trying to make a "newspaper" out of a quarterly journal is not all "cake and cookies" by any means. For example: We published in the March 1961 issue (page 117) an account of a three-day Surveying and Mapping Short Course scheduled to be held at the Georgia Institute of Technology, January 24–26, 1961.

This was based on an announcement of the short course, and the item was in the galley-proof stage before the meetings were scheduled to be held.

Now, on May 10, 1961, we received a letter, dated May 3, 1961, from ACSM member E. C. Moore of Hammond, Louisiana, which reads in part, as follows:

"A news item in the March 1961 issue missed the main item. On page 117, there is an article about a three-day short course at Atlanta. The first day's session was called off because of bad weather, and, as the forecast the morning of the third day was for worse weather, I left. Perhaps it was only a one-day short course."

And there you have it! Your editor has, in the past, "stuck his neck out" on numerous occasions by rewriting announcements in the past tense in order that the news might not be delayed unduly. But this is the first time that the "judo chop" has caught up with him and made him out a liar, nincompoop, or what have you.

In self defense, we, as of now, establish an editorial policy, to wit: When an item in "News of Related Organizations" or "Congress News" is based on information received before the actual occurrence of the event, the item will not be rewritten in the past tense, as was the one referred to above, but will be properly qualified either in the wording of the item or be followed by a date indicating the date of the preparation of the copy, or both.

And this brings us to a point which has been bothering us for a long time. The material for the "News of Related Organizations" and the "Congress News" departments of SURVEYING AND MAPPING is gathered from all sorts of sources—newsletters, copies of correspondence forwarded by the Executive Secretary, copies of minutes of meetings, etc.—and most of this material is in a form which requires rewriting for publication. That is a time-consuming job to say the least and fraught with pitfalls of various sorts.

One remedy—a partial one at least—would be for the secretaries, editors, or other officers in the various organizations, charged with the forwarding of news items for those departments, to get their material in promptly, addressing it directly to the Editor, SURVEYING AND MAPPING, 6712 Fourth Street, N.W., Washington 12, D. C., and further help will be derived if the copy can be typed, double spaced, on standard letter-size paper, face and one carbon, with wide margins.

A fact that seems to be overlooked by many who send us material is that, except for last minute material for which the copy goes forward with the dummy, there is a minimum of nearly two-months lag between the time for copy to go to the printer and the time when the finished magazine is received by the individual member. In fact, one issue is never out before the next one has been started.

There is no way in which a badly worded, single-spaced bit of copy can be put into type without a very considerable amount of extra work. At best the editing, marking, typesetting, galley proof, make up, page proof, and page-proof revises when necessary all take time. Please, all concerned, do not make matters worse by delaying the forwarding of copy. It *can* happen that a one-day delay in the receipt of a bit of copy will mean a three-months delay in getting the item into the Journal.

Wiley BOOKS

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HIGHER SURVEYING, Eighth Edition

Volume II of Principles and Practice of Surveying

By the late CHARLES B. BREED *and the late* GEORGE L. HOSMER*;*
Revised by A. J. BONE, *Massachusetts Institute of Technology.*

Breed and Hosmer's *Principles and Practice of Surveying* has been the classic text and reference in its field for more than half a century. Its clarity, thoroughness, and balanced emphasis on theory and practice are of course all major factors in this remarkable success. Equally important, however, is the fact that each volume has periodically undergone complete revision so as to offer readers the most up-to-date information possible. Thus, the new edition of Volume II, *Higher Surveying,* offers complete coverage of the latest advances in surveying technology and methodology — while retaining a philosophy and an approach to the subject that have proven themselves again and again over the years. A wealth of new material has been added, particularly on such subjects as photogrammetry and its applications, plotting and finishing topographic and hydrographic maps, and the use of error analysis in planning and conducting surveys. At the same time, obsolete material has been carefully edited out. The figures, illustrative examples, problems, and bibliography have all been thoroughly revised to conform to the changes made in the text. The eighth edition retains the same compact, easy-to-carry size that contributed to the popularity of previous editions among students and practicing engineers. *1961. In press.*

ELEMENTARY SURVEYING, Ninth Edition

Volume I of Principles and Practice of Surveying

By the late CHARLES B. BREED *and the late* GEORGE L. HOSMER*; Revised with the assistance of* A. J. BONE, *Massachusetts Institute of Technology. 1958. 717 pages. $6.50.*

SURVEYING, Second Edition

By the late CHARLES B. BREED. *1957. 495 pages. $5.50.*

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Books in Review

FROM THEORY TO PRACTICE IN SOIL MECHANICS, Selections From the Writings of KARL TERZAGHI. L. Bjerrum, A. Casagrande, R. B. Peck and A. W. Skempton. *John Wiley and Sons, Inc.*, New York, 1960, 425 pages.

This is a portrayal of Karl Terzaghi's leadership in the development of soil mechanics as an important branch of civil engineering.

Personality sketches are presented in a short biography. His career as geologist, teacher, and international consultant on soil problems is traced from his birth in Austria in 1883 to the present. His thorough and imaginative method of working is shown by notes of his associates and his own article on Consultants, Clients and Contractors, and selected, complete, professional reports on Settlement, Bearing Capacity, Tunneling, Cofferdams, Earth Dams, and Stabilization of Landslides. His achievements are presented through a review of his discovery of the powerful concept of effective stress, and selected professional papers (including some new translations) which show how he established the fundamental principles of soil mechanics and used them in his engineering practice.

Terzaghi's philosophy on the aim, scope, and method of soil mechanics is given in his presidential addresses to several international conferences on soil mechanics and the introduction to his classic book, *Erdbaumechanik* (1925).

Theory is considered secondary to thorough exploration, critical observation, and sound judgment.

A bibliography of 256 articles gives his publications from 1906 to 1960.

The volume is intended to honor Karl Terzaghi and to demonstrate the prerequisites and techniques for the successful practice of soil mechanics. —EDWARD S. BARBER

BOOK NOTES

TRANSFORMATION OF RECTANGULAR SPACE COORDINATES. Erwin Schmid. Coast and Geodetic Survey Technical Bulletin No. 15, December 1960. Paper cover, 8 × 10, 13 pages, illustrated. Superintendent of Documents, Government Printing Office, Washington 25, D. C., $0.15.

It is believed that the purpose and scope of this bulletin can best be set forth by quoting the "Introduction" to the publication:

"Fixing the position of points on the earth's surface by means of the two variables latitude and longitude is one of the most familiar examples of the use of a curvilinear coordinate system, leading to a (two-dimensional) non-Euclidean geometry, the geometry of curved spaces. This description of points is not only more elegant, in a mathematical sense, than would be a three-dimensional rectangular coordinate system but is a practical necessity as well. A rectangular (Cartesian) coordinate system implies the measurement of distances along straight lines, whereas the geodesist is, in effect, restricted to measuring along the curved surface of the earth.

"On the other hand, in dealing with points not lying on the assumed surface of the earth, it is necessary to introduce a third dimension, and for many purposes it is convenient to introduce a three-dimensional rectangular coordinate system, familiarly known as an x, y, z or i, j, k system, with its concomitant Euclidean metric—the Pythagorean theorem.

"The conversion of geodetic coordinates to x, y, z coordinates requires only the most elementary notions of analytic geometry in addition to some basic geodetic concepts, but as the latter are not universally known to scientists whose fields have in recent years, with the development of missiles, been broadened to include geodesy, it was felt that a compilation of such formulas would serve a useful purpose."

UNITS OF WEIGHTS AND MEASURES (UNITED STATES CUSTOMARY AND METRIC)—DEFINITIONS AND TABLES OF EQUIVALENTS. L. V. Judson. National Bureau of Standards Miscellaneous Publication 233 (supersedes Miscellaneous Publication 214) issued December 20, 1960. Paper cover, 8 × 10, 62 pages. Available from the Superintendent of Documents, Government

Printing Office, Washington 25, D. C., at $0.40 per copy.

A 1959 agreement among the directors of National Standards Laboratories of English speaking nations to obtain uniformity in precise measurements involving the yard and the pound have brought about refinements in the definition of the U. S. customary units of length and mass, and have made a revised edition of this publication desirable.

The units of length, area, volume, capacity, and mass in the United States are defined in conformity with the 1959 agreement, and the tables of interrelation and tables of equivalents for these units in the metric system and in the U. S. customary system have been recalculated by automatic computer.

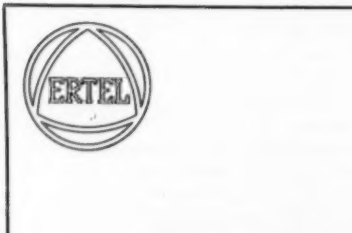
Further revisions include the deletion of the table showing interrelation between bushels and hectoliters and the addition of a more complete table showing equivalents of inches in millimeters.

CIVIL ENGINEERING EDUCATION. American Society of Civil Engineers. Publication 1961-6, cloth cover, 6 × 9, 189 pages. $1.00.

This publication bears the subtitle "A Study Sponsored Jointly by The Cooper Union for the Advancement of Science and Art, The American Society of Civil Engineers, The American Society of Engineering Education under a grant by The National Science Foundation 1959–60."

Included in this book are the complete proceedings of the Conference on Civil Engineering Education held at Ann Arbor, Michigan, July 6–8, 1960, list of delegates, and other incidental material.

IT IS NOT TOO EARLY TO BEGIN PLANNING
TO ATTEND THE 1962 MEETINGS
SHOREHAM HOTEL, WASHINGTON, D. C., MARCH 11–17, 1962



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News of Related Organizations

Association of Ontario Land Surveyors

The Association of Ontario Land Surveyors held its 69th Annual Meeting, February 13–15, 1961, at the Prince Edward Hotel in Windsor, Ontario.

The meeting was, as usual, well attended, with 200 members registered, many of them accompanied by their wives. To convey some idea of the size of the Province they represent, there were several in attendance who had traveled a greater distance than your reporter from Massachusetts.

The three days of the meeting were crammed full of technical and professional papers of high caliber, together with many hours of intensely active deliberations of a business and professional nature in connection with the supervision and direction of an active, forward-looking, professional group.

Highlights among the technical papers included "Highway Drainage," by David M. Bews, and "Plane Coordinates in New Brunswick," by Lt. Col. Willis F. Roberts, Director of Surveys, Province of New Brunswick. The latter was a well documented, illustrated description of the actual beginnings in the development of a plane coordinate system for the Province. This paper was of unusual value as it presented for the first time in your reporter's experience a rather exact analysis of the cost by unit of such a project. In a very well organized paper entitled "Extension of Geodetic Triangulation, Lake Erie, 1960," J. B. Boyd of the Department of Mines and Technical Surveys, Dominion of Canada, described a 200-mile Tellurometer-Geodimeter-theodolite traverse along the shore of Lake Erie, surveyed with great speed and efficiency and used to control the location of offshore drilling rights.

Perhaps the outstanding item on the program was a panel presentation entitled "Review of the Technical and Legislative Matters That Affect the Ontario Land Surveyor." This was an analysis of two legislative items affecting the profession that appear to be of primary importance: one, the eventual availability of a useful-to-the-land-surveyor, plane-coordinate, control-survey system throughout the Province; and second, the desirability of the immediate establishment of a Province-wide directorate of survey, which would provide central filing repositories for all survey maps, plats, and field notes; would supervise the accuracy and completeness of surveys filed; and probably would eventually see to the protection and extension of the control-survey net cited above. The papers were prepared with characteristic thoroughness by a well chosen panel, chaired by S. G. Gamble, Director, Surveys and Mapping Branch, Department of Mines and Technical Surveys, Dominion of Canada. No immediate solutions were reached but it was obvious they were on the way.

A spade-calling paper on "The Professional Status of the Land Surveying Profession in the United States," presented by Ralph Moore Berry, Professor of Geodesy, University of Michigan, and a Director of the ACSM, was very well received. The paper forcibly described the dismal past and clearly noted the many cheerful signs in the present for a better future.

Another inspiring presentation described the organization and the aims of the Association of Survey Technicians, an organization of the many highly skilled employees of Ontario land surveyors with obviously well-defined educational and technical goals for the future. It seemed to this observer that here was the ideal answer to the union problem which besets our profession in so many parts of our country. The paper was ably presented by Fred Marsh, President of the Ontario Association of Survey Technicians.

To give some small idea of the extent of the normal activity of the Association, there were formal, well prepared, and extensive reports from standing committees on education, land surveying, biographies, drainage, mining, aerial surveys, town planning, publications, legislation, and entertainment.

The meeting was capably chaired throughout by H. D. G. Currie, ably assisted by Incoming President Maurice Hewett and members of the Board of Directors.

The social part of the program, which comprised numerous delightful affairs, was rounded out by an informal dinner held in conjunction with the Michigan Society of Registered Land

Surveyors, whose annual meeting in Detroit was just getting under way.

—A. PHILLIPS BILL
Past Chairman, PSD of ACSM

Land Surveyors' Association of Washington

Officers of the Land Surveyors' Association of Washington for the current year are:

President—R. L. Stuhr, Lynnwood
Vice President—LeRoy F. Middleton, Edmonds
Executive Secretary—Yeager A. Bush, Seattle
Secretary—William L. Snell, Seattle
Treasurer—Robert Jones, Mercer Island

Mr. Middleton will also serve as PSD-Division Advisor for the LSAW.

Illinois Registered Land Surveyors Association

From *The Illinois Surveyor,* March 1961, we learn that the May 1961 meeting of the Illinois Registered Land Surveyors Association was scheduled to be held in Vandalia, Illinois, on May 12, 1961.

The annual election of officers, held on February 13, 1961, resulted in the election of the following:

President—Wilbur M. Francis
Vice President—Dwain M. Wallace
Secretary—Winfield H. Eldridge
Treasurer—Charles S. Danner
Directors—(1 year) Donovan Anderson and Fred Freidewald; (2 year) George Chlebicki and Frank Kaplan.

About 130 persons attended the Fourth Annual Illinois Land Surveyors Conference which was held on the campus of Illinois University February 13–14, 1961. Persons attending came from a total of nine States. It is reported that this was a highly successful meeting. The Fifth Annual Conference is scheduled to be held at the university February 12–14, 1962.

During the business meeting at Urbana, February 13, 1961, it was voted to sponsor some deserving student to attend the Summer Surveying Camp in northern Minnesota this summer. The camp is required of all civil engineering students, and, coming as it does in the summer, presents a financial burden for most students. The aid will be presented in the form of a check for $250 to cover costs of tuition, transportation, living expenses, and loss of earnings. The selection will be made from students attending the Urbana Campus or Navy Pier who have applied, and the selection will be based on interest in surveying, financial need, and scholastic ability.

Norman Nestor of Urbana and Dave Causey of Rantoul have been named editor and co-editor, respectively, of *The Illinois Surveyor,* succeeding Winfield H. Eldridge who was listed in the masthead of the December 1960 issue as "acting editor."

Central New York Society of Land Surveyors

We learn from the Central New York Society of Land Surveyors' publication *Bench Marks* that the March 1961 meeting, in addition to a number of items of routine business, included a presentation by Bruce Stanton of slides, taken at the recent statewide meeting, and the color film "Prosperity of Water." This film depicts the history of the municipal water system for Syracuse, N. Y., and its surrounding area since its origin in 1800. Due to the expanding population and industrial development since that time, Syracuse is rapidly reaching the point where it is exhausting its present water supply and must now search and plan for new sources. The film was sponsored by the Syracuse Chamber of Commerce.

The April meeting of the Central New York Society of Land Surveyors was held April 4, 1961, with President Tarbell presiding. Sixteen members were present.

Lou Jones stated that the mimeographed proceedings of the Statewide Surveyors Meeting would be completed and ready for distribution within a week.

Peter Gursky reported that the Albert-Farrington bill had been killed in committee. Bruce Stanton volunteered to produce 20 copies of this bill for further study by the Society.

Mr. Stanton, who attended the ACSM Annual Meeting in Washington, reported that this had been the best meeting ever and suggested that the Society delegate at least two members annually to the Washington meetings and furnish sufficient funds for their expenses.

President Tarbell directed Lou Jones and Jack Cottrell to investigate city laws regarding the destruction of city monuments by utility and construction companies; also to contact the City Engineer or other city officials regarding this matter.

Tom Barnell, a North Syracuse attorney, gave an interesting talk on procedures in billing, types of statements to be sent to clients, and other

means of collecting fees. A question-and-answer session followed the talk.

A. S. E. E.

The 69th Annual Meeting of the American Society for Engineering Education will be held at the University of Kentucky, Lexington, Ky., June 26–30, 1961. New officers elected for terms beginning July 1, 1961, are:

President—Dr. Robert W. Van Houten, President of the Newark College of Engineering and Director of the Newark Technical School,

Vice Presidents—Dr. George A. Marston, Dean of Engineering, University of Massachusetts, and Dr. Curtis L. Wilson, Dean of the Missouri School of Mines and Metallurgy, and

Treasurer—Wendel W. Burton, Minnesota Mining and Manufacturing Company.

Illinois Registered Land Surveyors Association

The spring meeting of the Illinois Registered Land Surveyors Association was held at the Robbins Motel, Vandalia, Illinois, on May 12, 1961. A buffet dinner began at 6:30 p.m., and was followed by musical entertainment provided by a trio of girls. The business meeting convened at 8:00 p.m., and was followed by an address by Joseph Dees, an attorney, on the subject, "An Attorney's Thoughts About Surveys."

It is reported that the IRLSA has doubled its membership in the last six months, and that they are going all out for a further increase.

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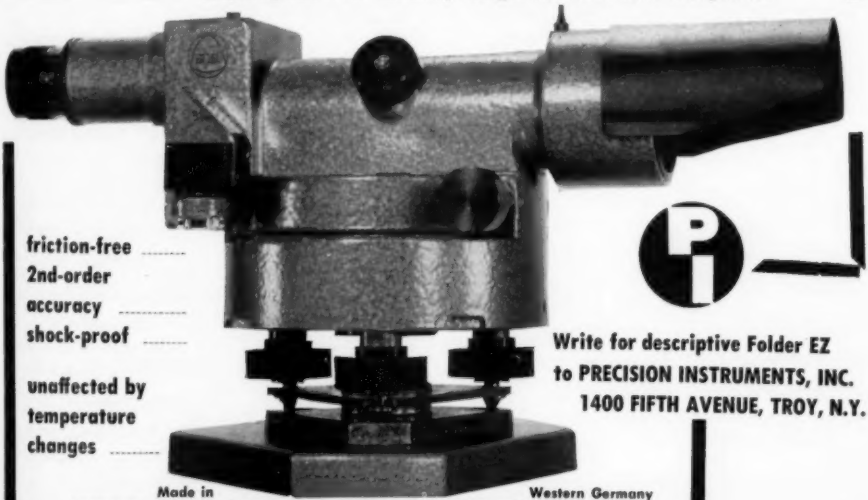

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Congress News

Arizona Section

The annual election of officers and directors for the Arizona Section, ACSM, resulted in the election of the following:

Chairman—Robert L. Frazer
First Vice Chairman—Clyde L. Armstrong
Second Vice Chairman—E. H. Jenkins
Third Vice Chairman—James Ellis
Secretary—James Reed
Treasurer—John H. Bagshaw
Directors—John H. Stitzer, Ramon Elias, Philip B. Newlin, William H. Wheeler, Daniel M. Wier, and outgoing chairman James D. King.

The Eighth Annual Arizona Land Surveyor's Conference was held at the University of Arizona on March 25, 1961.

The Regional Convention of the American Congress on Surveying and Mapping is to be held in Phoenix, Arizona, October 18–21, 1961.

—James J. Walden
Section Editor

Cartography Division

At a meeting of the Executive Board of the Cartography Division, ACSM, held January 25, 1961, the principal items of business seem to have centered around plans for the First General Assembly of the International Cartographic Association scheduled to be held in Paris, May 29 to June 5, 1961.

Five delegates from the Cartography Division, ACSM, have been designated to attend—Duncan Fitchet, Granville K. Emminizer, Arthur F. Striker, Robert J. Voskuil, and Robert J. Beaton. In addition, the Secretary-General of the I. C. A. has been requested to permit three additional individuals from the United States to attend as observers without the status of delegates—Dr. Arthur Burt, State Department; Russell L. Voisin, Rand McNally Company; and Gordon E. Stine, Aeronautical Chart and Information Center.

Delaware Valley Section

The Delaware Valley Section, ACSM, came into being officially on March 8, 1961. Kenneth L. Pyle, acting Secretary for the petitioners, was designated Chairman pro tem, pending formal election of officers for the Section. His address is c/o Montgomery County Planning Commission, Courthouse, Norristown, Pennsylvania.

The area included within the "territorial limits" of the Delaware Valley Section comprises the Pennsylvania counties of Philadelphia, Bucks, Montgomery, Chester, Delaware, Berks, Lehigh, Northampton, and Lancaster; the New Jersey counties of Mercer, Burlington, Camden, and Gloucester; and that part of New Castle County, Delaware, which lies north of the Chesapeake and Delaware Canal.

Utah Section

The first regular 1961 meeting of the Utah Section, ACSM, was held February 23, 1961, in Room 322 of the Union Building at the University of Utah. The meeting was called to order at 7:30 p.m., with 16 members and guests in attendance.

In his opening remarks, Chairman Clifford G. Bryner announced that the Executive Committee had decided that until further notice the mailing address for the Utah Section will be: Annex 242, University of Utah, Salt Lake City 12, Utah.

Chairman Bryner also announced that the Executive Committee for 1961 would include last year's chairman plus the 1961 officers.

He also announced that the December conference at the University of Utah will be cosponsored by the Public Works Association and the Utah Council of Land Surveyors. The committee for the annual conference will include Herbert P. Lee, Jr., F. Wayne Forest, and I. E. Rittenburg.

It was also announced that the Advisory Committee for Utah Land Surveyors would be made up as follows: Clifford G. Bryner, for the University of Utah; Lloyd Toland, for the Bureau of Land Management; Herbert P. Lee, Jr., for the photogrammetrists; J. D. Hill, for the A.S.C.E.; C. V. King, for the Intermountain Institute of Consulting Engineers; and Robert Jones, for the Utah Council of Land Surveyors.

A motion was passed designating Jay Sweet and Peter H. Stavros to serve with I. E. Rittenburg, Chairman, as a standing committee to

work with other groups in Utah interested in a Utah Information Center for Surveying Monuments. The committee was instructed to report back to the membership in 60 days. The chairman requested the committee members to make a pilot study of what is going on elsewhere and report to Section Chairman Bryner by March 12th, so that he can be briefed on what questions should be raised and what answers can be given at the annual meeting of the ACSM.

The speaker for the evening was Carl Lambert of the Computer Section, Utah Highway Department, who gave a very interesting talk on "A Computer Program for Surveyors and Engineers." The talk was followed by a discussion period, with the discussion centering on what methods need changing, what forms need to be used, and what information can be obtained.

I. E. RITTENBURG
Secretary

Texas Section

At its meeting of April 7, 1961, the Texas Section, ACSM, was privileged to hear ACSM Past President Lester C. Higbee discuss "Engineering Instruments—Here and Abroad." Members of the Texas Surveyors Association and all Registered Public Surveyors were also invited to attend the meeting, which was held at Del Webb's Hiway House in Houston, Texas.

North Carolina Section

A joint meeting of the North Carolina Section, ACSM, and the PS&M Functional Section of the Professional Engineers of North Carolina was held March 21, 1961, at the C & C Cafeteria, Charlotte, N. C., with Benjamin L. Smith, Jr., Chairman, N. C. Section, ACSM, presiding. Eleven members and one guest were in attendance.

David Vance, Instructor at Gaston Technical Institute, Gastonia, N. C., was the speaker for the evening. He discussed the different schools and courses offered by the Gaston Technical Institute, and possible employment of the technical graduates by firms such as were represented at the meeting. The speaker and his information were well received.

It was suggested that our meetings be alternated between the Charlotte and Greensboro areas. It was agreed that our next meeting will be held in the Salisbury area. Chairman Smith asked each member to bring at least one or more members to increase the attendance.

Chairman Smith presented a letter from Robert Rice, a letter which was sent to several of our members in the Greensboro area. In this letter Mr. Rice referred to a possible second examination for land surveyors, giving them more flexibility in subdivision design and development. Mr. Smith read sections from the State of Virginia law relating to a second examination for land surveyors, after which our law would be modeled. This second examination would give the qualified land surveyor the legal authority to design streets (alignment and grades), and to design storm drainage, sanitary sewers, and water systems for subdivisions.

Robert Guarino moved that we recommend to the North Carolina Board of Registration for Engineers and Land Surveyors that we will approve essentially the same law as is set forth in the State of Virginia, but that we restrict the high-class registration to the design of water lines, sanitary sewer lines, road grades and profiles, curbs and gutters, storm drainage, etc., which would be under the jurisdiction of a governing body where standards have been set forth. Preclude subdivisions that do not fall under this jurisdiction and where possible water supplies, sewerage treatment, major thoroughfare plans and drainage systems may be involved. That it not be called "Engineering Surveyors," that we ask the North Carolina Board of Registration for Engineers and Land Surveyors to have their attorneys draft the law, but that the ACSM have the opportunity to edit and review before it is enacted into law. The motion was seconded by Robert Wilson and approved by a majority vote.

Chairman Smith asked those present what their feelings were in regard to the Uniform Map Law in all the 100 counties of North Carolina. The vote in favor was unanimous.

—DALE J. MILLS
Secretary

St. Louis Section

The phrase "you are twice welcome" certainly applied to Admiral Karo when he visited the St. Louis Section, ACSM, February 1, 1961. He was welcomed as the former Commander of the Aeronautical Chart and Information Center and as President of the ACSM.

One hundred twenty members and guests of the St. Louis Section attended the meeting in the ACIC cafeteria.

A short business meeting preceded the highlight of the evening—a very inspiring address by Admiral Karo.

Bob Kingsley, in introducing the speaker, recalled many amusing incidents that occurred when "Colonel Karo" was Commander of the ACIC. This introduction set the stage for President Karo to address the Section in the dual capacity of old friend as well as the elected head of our society.

Admiral H. Arnold Karo, President, ACSM, (*left*) and Robert H. Kingsley, ACIC, at the meeting of the St. Louis Section, ACSM, February 1, 1961.

The St. Louis Section has annuonced that plans for the joint meetings—ACSM Regional Conference and the ASP Semiannual Convention—have definitely scheduled this venture for September 9–14, 1962, at the Chase Hotel in St. Louis, Mo.

Officers for the convention board will be:

Director—G. A. Harper
Deputy Director—A. R. Albaugh
Deputy Director (Finance)—W. T. Riordan
Member—K. T. Sime
Member—G. E. Stine

It has also been announced that Charles Frey has been nominated for Section Chairman to succeed incumbent Gordon E. Stine and that Robert Kingsley has been nominated for Vice Chairman. The Section is also voting to amend its constitution to effect automatic succession to the chairmanship from the vice chairmanship.

Section Chairman Gordon E. Stine, of the Aeronautical Chart and Information Center, will attend the International Cartographic Association meeting in Paris, France, May 29 to June 3, 1961—its First General Assembly.

Attention! Sections and Affiliates!

See the "Editory Yell" on page 261 of this issue of SURVEYING AND MAPPING.

Personals

The California Council of Civil Engineers and Land Surveyors, in the *Newsletter* for March 1961, lists the following members of the ACSM on its Executive Committee: **Charles W. Christensen,** San Diego, President; **Harold W. Musser,** Marysville, First Vice President; **F. William Pafford,** Los Angeles, Second Vice President; and **Walter J. Hanna, Jr.,** Gilroy, Junior Past President. **William A. White,** Sacramento, is Executive Director.

George C. Bestor, Past President, ACSM, was the recipient of one of two awards made as a result of a contest, among members of the California Council of Civil Engineers and Land Surveyors, for planning projects. Mr. Bestor's winning entry was the "Proposed Master Plan for Leguna Seca Rancho." This is a 984-acre property located between Monterey and Salinas, California.

At the Honor Awards ceremonies of the Department of Commerce, February 14, 1961, Lieutenant Commander **Eugene W. Richards** of the Coast and Geodetic Survey was cited for "extremely competent performance of official duties; primarily, his demonstration of unusual ability in assuming command of vessels under emergency conditions." Lcdr. Richards was recently assigned to the Office of Oceanography in the Washington office of the Survey. He was previously in command of the *Patton*.

G. Brooks Earnest, President of Fenn College, Cleveland, Ohio, was the principal speaker at the February 23rd meeting of the Canton Regional Society of Professional Engineers. His subject—"Engineering, a Career of Opportunity."

Carl W. Keuffel, who joined the Keuffel & Esser Company in 1913, has retired from his position as president of that company. He was elected to the board of directors in 1935, secretary in 1942, vice president in 1946, and became president in 1950. He is succeeded by Alfred E. Busch of Short Hills, N. J.

Professor **Arthur J. McNair** is now President, and **James P. Webb** is First Vice President of the American Society of Photogrammetry.

Richard T. Evans, Treasurer of the ACSM from 1943 to 1957, has accepted an invitation to attend the dedication ceremonies at the new Visitor Center, Zion National Park, June 17, 1961. Major Evans is in the "I knew 'em when" class as far as Zion National Park is concerned.

He was "loaned" by the U. S. Geological Survey to officiate as Acting Superintendent of the Park during the open season (May to October) in both 1925 and 1926, and he made the topographic map of Zion National Park in 1929 and 1930.

Herman J. Shea, a former Associate Professor in the Department of Civil and Sanitary Engineering at the Massachusetts Institute of Technology and lately Chief Engineer of the James W. Sewall Company, has recently joined the staff of New England Survey Service, Inc., of Boston, Massachusetts, and Newington, Connecticut.

T. J. Blachut, First Vice President, Canadian Institute of Surveying, has been awarded the Honorary Medal of the Technical University of Milan.

Kansas City Section

A petition for authority to organize the Kansas City Section of the American Congress on Surveying and Mapping has been received by the Executive Secretary, ACSM, and was approved May 4, 1961. The Kansas City Section scheduled a meeting for May 24, 1961, at which it was expected that ACSM President Brother B. Austin Barry would be present to institute the new Section. This new Section will serve the metropolitan area of Kansas City, Missouri.

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Wild-Heerbrugg Award—1961

The Wild-Heerbrugg Award[1] for 1961 went to Andrew Nagy, Registered Professional Engineer, 124 Old Oak Drive, Bridgeville, Pennsylvania, for his paper "Triangle Chains for Supplemental Control."[2]

Dr. h.e. A. J. Schmidheini from Heerbrugg, Switzerland, made the presentation of this first Wild-Heerbrugg Award at the business meeting of the American Congress on Surveying and Mapping on Friday, March 24, 1961, during the ASP–ACSM Convention at the Shoreham Hotel, in Washington, D. C.

The Institute of Geodesy, Photogrammetry and Cartography of the Ohio State University was the recipient of the $250 gift-award, as the school selected by the winner as his choice. Dr. Waikko A. Heiskanen, Director of the Institute, accepted the award for the Institute.

Mr. Nagy's paper was judged the best of a field of five entries submitted for the 1961 award. The other papers submitted were:

"Characteristics of the Errors in the Subtense Method of Distance Measurement," by Sam F. Madonia, University of Illinois.

"Distance Measurement by Sound," by Robert J. Schultz, Western Electric Company.

"Design of an Optical System for Measuring Small Angular Changes," by Pablo Larrea, Cornell University.

"Leveling With the Polaroid Camera," by Charles R. Fernandez, Louisiana Polytechnic Institute.

[1] *See* SURVEYING AND MAPPING, March 1960, Vol. XX, No. 1, page 133 and June 1960, Vol. XX, No. 2, page 226.

[2] Because this paper is a rather long one, and because it will present some difficulties in preparing the copy for the printer, it will not be published before the September 1961 issue of SURVEYING AND MAPPING, and it may be delayed until the December 1961 issue. However, it will be well worth waiting for. —EDITOR

Wild-Heerbrugg Award—1962

Wild-Heerbrugg Instruments, Incorporated, has again offered the "Wild-Heerbrugg Award" for the year 1962. In order that this award may receive as wide publicity as possible we are again publishing the Deed of Award as it appeared in SURVEYING AND MAPPING, March 1960, Vol. XX, No. 1, page 134. An announcement concerning the winner of the 1961 award will be found elsewhere in this issue. —EDITOR

DEED OF AWARD

WILD-HEERBRUGG INSTRUMENTS, INCORPORATED

ARTICLE I—*Name and Purpose*

A. The name of the award is to be The Wild-Heerbrugg Award.

B. The purpose of the award is to encourage both practicing surveyors and students in the engineering sciences or in surveying to develop new uses, techniques or instrumentation in the fields of land surveying, industrial surveying applications, or geodesy.

ARTICLE II—*Value*

A. The award shall consist of a cash donation of $100.00 and a gift of $250.00 to the Civil Engineering or respective Surveying Department of an educational institution to be named by the recipient of the award. The award winner will furthermore have the use of a specially marked T-2 Theodolite for one year, such instrument to be returned annually to Wild-Heerbrugg Instruments, Incorporated, for inspection and adjustment, if necessary, before delivery to the following year's recipient. The award will be made annually.

B. In the case of joint authorship, the prize shall be divided by the authors. Use of the T-2 Theodolite shall be by mutual consent between the authors.

C. If no award is made in any one year, the cash prizes shall be added to the amounts to be awarded next year.

D. Wild-Heerbrugg Instruments, Incorporated, shall provide for the annual prizes to be awarded and shall also underwrite the incidental expenses of providing the recipient with a suitable scroll, and of presenting the award.

ARTICLE III—*Basis of Award*

A. Competition for the award is open to any individual members, or group of members of the American Congress on Surveying and Mapping, and to any student, or groups of students in a recognized college or university in the United States. A student must have been registered within the period from January 1st to December 31st of the year of competition.

B. The award shall be made on the basis of papers submitted to the editor of the Journal of the American Congress on Surveying and Mapping for publication in the Journal. Such papers

or articles shall describe original theories, research or practices in surveying techniques or instrumentation.

C. The deadline for submission of papers each year shall be January 31st.

ARTICLE IV—*Conditions of School Award*

A. The cash gift to an educational institution of the award winner's choosing (*See* Article II, Paragraph A) shall be appropriated by the department head in charge of surveying for purposes of furthering surveying instruction. The funds shall be used within two years from receipt.

ARTICLE V—*Judges*

A. Papers will be judged, and the award administered, by a committee appointed by the President of the American Congress on Surveying and Mapping. It is suggested that the Control Surveys and Property Surveys Division as well as the Editorial Staff have representatives on the Committee. Decisions of the Committee shall be final, subject to approval by the Board of Directors.

ARTICLE VI—*Presentation of Award*

A. The presentation of the award shall be made by a member of the Committee during the Annual Meeting of the American Congress on Surveying and Mapping.

ARTICLE VI—*Amendments*

A. If any of the terms of this award become inapplicable to existing conditions, the Donor will consider suggested changes.

ARTICLE VIII—*Term of Award*

A. This award will continue indefinitely, subject to agreement of officers of A.C.S.M. and of Wild-Heerbrugg Instruments, Incorporated.

Keuffel & Esser Fellowship in Surveying—1961

The Keuffel & Esser Fellowship in Surveying* for the school year 1961–62 was awarded to James L. Clapp, a graduate student in surveying and mapping at the University of Wisconsin. The award was made at the March 1961 Annual Meeting of the American Congress on Surveying and Mapping. Because Mr. Clapp could not be present to receive the award in person, it was accepted on his behalf by Professor Eldon C. Wanger of the University of Wisconsin.

The award committee comprised Brother B. Austin Barry, at that time Vice President of the ACSM; Captain H. W. Hemple, Treasurer of the ACSM, and Karl Keuffel, President of Keuffel & Esser Company.

Mr. Clapp was one of eight contestants for the award, the others were:

Lee Duward Miller, Ann Arbor, Michigan,
Robert A. Nack, Urbana, Illinois,
Atef A. Elassal, Urbana, Illinois,
Martin C. Fisher, Lexington, Virginia,
George E. Kattouah, Detroit, Michigan,
Gordon Gracie, Urbana, Illinois, and
LeRoy H. Sommers, Madison, Wisconsin.

**See* SURVEYING AND MAPPING, September 1960, Vol. XX, No. 3, page 381.

ACSM ANNOUNCES SECOND K. & E. AWARD—

The Keuffel & Esser Fellowship in Surveying

DEED OF AWARD

A. The name of the award is the Keuffel & Esser Fellowship in Surveying.

B. The purpose of the award is to encourage better students in Civil Engineering to do graduate work and specialize in surveying.

C. The award shall consist of a fellowship for one graduate student, amounting to $1,000 plus tuition for one year. The recipient of the award shall select the school where he will take graduate work in advanced fields of surveying.

D. The recipient of the award shall be selected by a "Keuffel & Esser Fellowship in Surveying" committee appointed by the president of the A.C.S.M.

RULES AND REGULATIONS FOR MAKING AND ADMINISTERING THE KEUFFEL & ESSER FELLOWSHIP IN SURVEYING

I The "Deed of Award" is incorporated by reference.

II The Keuffel & Esser Fellowship in Surveying Committee shall be appointed by the President of the ACSM to reflect objectively the educational, technical, scientific, and professional interests of ACSM.

The committee shall be comprised of not less than three or more than five appointed members. The Executive Secretary of ACSM will

serve ex officio with the committee for reasons of continuity and official record.

Decisions of the committee shall be final.

III The award shall be made by May 15 for the next school year.

Applicants shall file in proper manner with ACSM Secretariat prior to January 1 of the awarding calendar year to be eligible for the award for the next school year.

Soon after January 1 of the awarding year, the committee (II above) shall strive to select the winner of the award from the eligible applicants prior to the annual convention of ACSM for pronouncement and presentation if feasible during the convention.

Applications shall reflect applicant's educational background, transcript records of scholastic ability, extra curricular activities, experience, supporting letters of recommendation and financial needs of the applicant, and a photograph.

IV The tuition will be paid directly by Keuffel & Esser to the school. The $1,000 awarded will be paid in installments during the year as required by the student while enrolled in the school and successfully pursuing the course of study.

V Keuffel & Esser plans that the award shall be made on a year-to-year basis, subject to annual agreements of the officers of ACSM and Keuffel & Esser Co. This second award shall be made for the school year 1962–63.

Civil Engineering and Surveying Schools, and Surveying Instructors, are urged to make this award known to their students, and to cooperate accordingly in the filing of worthy applications.

Applications for the 1962–63 school year must be filed before January 1, 1962. Application forms will *not* be provided and are not required for filing in proper manner. Use white paper, usual standard bond 8½ × 11 (or comparable media), typed one side only. Follow instructions under Rule III. Include letters from your Surveying Instructor and records from your school's administrative department as appropriate and required. Your case will be judged on these facts and recommendations. Be concise but include all necessary particulars indicated under Rule III.

Mail applications to the Executive Secretary, American Congress on Surveying and Mapping, Room 430 Woodward Building, 733 15th Street, N.W., Washington 5, D. C. —EDITOR

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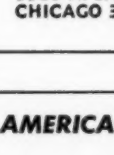

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ABBOTT, Harry W., 31702 Trevor Ave., Hayward, Calif.—Engineering Assistant, East Bay Municipal Utility District, Oakland, Calif.

ACOSTA, Claude M., 4255 E. 61st St., Kansas City 30, Mo.—Cartographer

ADDABBO, Munz Philip, Merritt Chapman & Scott Corp., P. O. Box 9508, Norfolk 5, Va.—Civil Engineer

ALLEN, Ernest L., 1373 Holiday Lane, Norfolk 2, Va.—Inspector, Sverdrup & Parcel

AMAI, Arleigh, L. K., 2563 Date St., Apt. 221, Honolulu 14, Hawaii—Draftsman, John Cline Mann

BAEHR, Miss Carolyn L., 7550 Byron Place, Clayton 5, Mo.—Cartographer, A.C.I.C.

BALLANTYNE, Charles J., 22 Kent St., Montpelier Vt.—Cartographer, Vermont Department of Highways

BAKER, Lt. Comdr. Leonard S., P. O. Box 4096, Patrick, AFB, Fla.—Party Chief, U.S.C. & G.S.

BARRON, Robert S., Missouri State Highway Dept., Jefferson City, Mo.—Drafting Supervisor

BASSETT, Don W., 1002 Mellinger Drive, Salina, Kans.—Land Surveyor

BELL, Robert R., P. O. Box 652, Tuskegee Institute, Macon Co., Ala.—Teacher, School of Agriculture and Engineering

BENNETT, Mrs. Eleanor M., 5516 Horton St., Mission, Kans.—Cartographic Editor, Army Map Service

BENNETT, Jack E., 115 E. 194th St., Seattle 55, Wash.—Land Surveyor, Hill & Ingman

BERNIER, Philippe, Public Works Dept., City of Montreal, Room 213, Viger Bldg., Montreal, Canada —Land Surveyor

BERRY, Edward L., Box 92, Route 3, Arnold, Mo.—Cartographer, A.C.I.C.

BINZEL, Rosemary, 2402 Bellevue Ave., Maplewood, Mo.—Cartographer, A.C.I.C.

BLOTEVOGEL, Victor G., Worden, Ill.—Negative Engraver, A.C.I.C.

BOLES, Elmore J., Jr., 112 W. Nippon St., Philadelphia 19, Pa.—Construction Engineer, Boles & Pagano

BORING, Paul L., Route 1, York, Pa.—Surveyor

BOWER, Richard Lee, 6255 Corona St., Apt. E, Bell, Calif.—Student, East Los Angeles Junior College

BOYDEN, Mark E., 2541 Sandy Terrace, Medford, Oreg.—Land Surveyor

BOYER, Louis B., 1311 Otis St., Lakewood 15, Colo. —U.S.G.S.

BRADFORD, Marian W., 1020 19th St., N.W., Washington 6, D. C.—Cartographer, Army Map Service

BRATCHER, Welba H., 9313 Richmond Ave., Kansas City 38, Mo.—Cartographer, Army Map Service

BRECKENRIDGE, Walter F., Bible Hill, Claremont, N. H.—Forester and Surveyor

BRITTENHAM, James D., 3008 N. 39th St., Phoenix 18, Ariz.—Arizona State Highway Dept.

BROCK, Ernest G., 711 Penn St., Washington, Mo.—Air Navigation Technician, A.C.I.C.

BROOKS, Edward T., 790 King Ave., Columbus 12, Ohio—Vice President, Photronix, Inc.

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TO ATTEND THE 1962 MEETINGS
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Now Hear This

Secretary of Commerce Luther H. Hodges announced on March 3, 1961, that bids are being accepted for the construction of the first two buildings of the new laboratories of the National Bureau of Standards to be built near Gaithersburg, Maryland. It is of interest to note that this announcement was made on the 60th anniversary of the establishment of the Bureau on March 3, 1901.

The revised 1961 catalog for Lefax, loose leaf, pocket size, Engineering Data Books is available from Lefax Publishers, Philadelphia 7, Pa.

Aero Service Corporation has announced that it is undertaking a survey of about 30,000 square miles of the Hashemite Kingdom of Jordan under a contract being financed by the International Cooperation Administration. Aero Service engineers will team with the Lands and Surveys Department of the Jordanian Government to carry out the ground surveys for the control of this extensive photogrammetric project. It is expected that the project will be completed and final maps delivered in 1963.

The March 1961 issue of *Tellurometer News*, published by Tellurometer, Inc., 305 Dupont Circle Building, Washington 6, D. C., has been brought to our attention. It is a four-page, 8½ by 11, illustrated publication, the purpose of which is stated in the following quotation from the masthead. "This news-letter is published regularly for owners and users of the hundreds of Tellurometer units in the United States and Canada. It carries news of developments in this field and actual experiences of practical value, as well as tips on operation and maintenance of equipment. The purpose of 'Tellurometer News' is to help you obtain the maximum benefit from your instrument."

The National Academy of Sciences and the National Science Foundation announced on April 3, 1961, that the experimental drilling ship *Cuss I*, operating in 12,000 feet of water off the west coast of Mexico, had obtained, for the first time, a sample of the so-called second layer under the softer sediments of the ocean floor. This layer, the presence of which had been previously indicated to scientists only by reflections of seismic soundings, has been revealed as basalt, a hard rock formed by the solidification of molten material within the earth.

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(*Continued on page 281.*)

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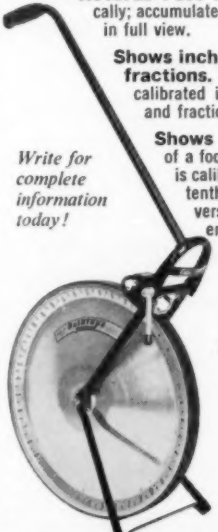

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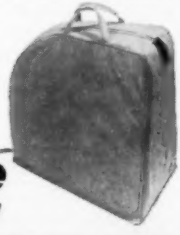

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Photogrammetry, held March 20–22, 1961, at the Shoreham Hotel, Washington, D. C., were two in number. The award in the graduate-student class went to William Howard Espey, Jr., of the University of Texas for his paper "The Profile of the Nappe as Determined by Photogrammetry." The undergraduate award was given to Pablo Larrea of Cornell University for a paper entitled "Design of a System for Photogrammetric Measurement of Small Angular Changes."

The California Council of Civil Engineers and Land Surveyors has awarded a $1,000 Planning Fellowship to Michael D. Flynn, a graduate student in civil engineering at the University of Southern California. This first annual fellowship was awarded to prepare a civil engineering student in the field of city, community, and land planning to assure proper design of future development projects.

The old order changeth—Keuffel & Esser Company has now broken a 75-year tradition and is bringing out its PARAGON transit in a matte, two-tone, green color instead of the traditional black.

One hundred of the questions asked most often about reproduction and drafting processes

(*Continued on page 284.*)

Photo/File

A new, lower-cost method of photo-recording highways and their appurtenances from the driver's point of view was announced February 1, 1961, by Aero Service Corporation. Called "Photo/File," the recording system employs a modified 16-mm camera. It provides a sequential record of the highway at regular 1/100 mile or 53-foot intervals.

Photo/File surveys are useful to highway engineers for sufficiency rating studies, as-built surveys, inventories of signs and other roadside conditions. Other uses include studies of traffic channelization, roadway re-design, maintenance need, and encroachment problems.

The Photo/File vehicle can survey at 5 to 60 miles per hour, continuously recording the highway situation at 52.8-ft. intervals, at a cost of about $15 per camera mile. Costs will vary, depending upon the total miles to be surveyed and the detailed requirements of each project. Such data recorded with still cameras, or with detailed observation and notes, would cost many times more.

Surveys are usually made during full daylight hours. Special studies can be made at dusk, in the early morning, or during rainy weather, for studies of highway and sign visibility at these times. Black-and white film is standard but color film can also be employed.

A data board at the bottom center of each photo frame provides a State code, the date, odometer reading in 1/100-mile units, the route number, and direction. Thus P 032160 00350 81071 N represents Pennsylvania, March 21, 1960, the odometer reading, the route, and the direction, north.

Photo/File film records can be projected on a large screen for conference studies or presentations to civic groups. Engineers find Photo/File well adapted for desk use also.

With a time and motion study projector, single frames can be projected at slow speeds. Projection can also simulate a driving speed of more than 100 m.p.h.

This sequential section of a Photo/File film, made during a test survey in Michigan, is enlarged five times. The inset (in circle) is a contact print of the same area. The data board at the bottom of each photo frame is keyed with a code letter designating survey area, date, odometer reading, route identification and direction of travel.

Radio Aids to Maritime Navigation and Hydrography

In 1956 the International Hydrographic Bureau issued Special Publication 39 entitled *Radio Aids to Maritime Navigation and Hydrography*.. This volume described radio systems and instruments used in navigation and hydrographic surveying, and contained the following chapters:

I—Spectrum and Propagation of Radio Waves

II—Radio Systems Used in Maritime Navigation

III—Radio Systems Used in Hydrographic Surveying

IV—Radar Technique

V—Radio Systems in Geodetic Surveying

VI—Reports on Use of Radio Systems in Hydrography

The English edition contains viii + 446 pages and includes 223 figures, of which 50 are full-page illustrations. The volume is available at $8.00 per copy.

Owing to rapid technical developments in this field, the Bureau is revising SP 39, dividing it into two publications entitled *Supplementary Papers to SP 39* and *Supplements to the International Hydrographic Review*.

SUPPLEMENTARY PAPERS TO SP 39

These papers will contain (1) new sections on recent instruments, and (2) reprints of sections reflecting present developments which do not require amendment. Together they will make up the new edition of SP 39. A loose-leaf binding will enable future ready revision.

The subject of the papers and frequency of publication will depend on receipt of the information at the Bureau. The price of each volume will vary according to the length of the text. Paper 1 relating to the Tellurometer and Micro-Dist distance-measuring systems, and Paper 2 concerning systems used in hydrography: Raydist, Hydrodist, M.P.F.S. (Microwave Position-fixing System) and Derveaux, were scheduled to appear late in December 1960. The former contains about 40 pages, and is priced at $1.00; the latter, of about 70 pages, costs $2.00.

Paper 3 now in preparation will discuss Decca and Lorac as used in hydrography. Its publication and that of later papers will be announced in the International Hydrographic Review and the International Hydrographic Bulletin.

SUPPLEMENTS TO THE INTERNATIONAL HYDROGRAPHIC REVIEW

These Review Supplements will contain reports from hydrographic and other organizations on instrument applications. They are intended to complete and later replace similar material in Chapter VI and a section of Chapter V of SP 39. Also included is a bibliography of reports reproduced elsewhere and of literature on radio aids. This series may also be considered as a supplement to the basic special publication. The Supplements will appear once or twice a year at unspecified dates usually between issues of the International Hydrographic Review. The price will vary according to the size of the volume.

Supplement 1 (October 1960) has been published. It contains about 150 pages and is priced at $5.00. Later supplements will be announced in the International Hydrographic Review and the International Hydrographic Bulletin.

Conditions of sale of International Hydrographic Bureau publications are as follows:—

Orders may be sent either to a bookseller or direct to the International Hydrographic Bureau, Quai des Etats-Unis, Monte-Carlo (Principauté de Monaco). Owing to exchange fluctuations, prices are quoted in U. S. dollars. Packing and shipping expenses are extra.

A reduction of 30% on the list prices is allowed to booksellers. The same reduction is granted to government offices and to naval or merchant marine officers of the States Members of the Bureau, provided the order is sent direct to the Bureau.

Payments to the International Hydrographic Bureau may be made by international money order; by cheque payable in Monaco; by transfer to the International Hydrographic Bureau's account at Barclays Bank Ltd., Chief Foreign Branch, 168 Fenchurch Street, London E.C. 3; or by transfer to the International Hydrographic Bureau's account at Barclays Bank D.C.O., 120 Broadway, New York, N.Y. Postage stamps or cash are not accepted.

(*Continued from p. 281*)

and materials are answered in a new six-page brochure available from Keuffel & Esser Co., Third and Adams Streets, Hoboken, N. J.

The A. & M. Data Processing Center administered by the Texas Engineering Experiment Station has added an IBM 709 computing system to the IBM 650 and IBM 604 machines previously in operation at the Center. The 709 system will be used on an around-the-clock basis to accommodate the various needs of research, education, and administration of the Texas A. & M. College System.

Canada's continuing program of scientific research in its polar regions in 1961 will cost an estimated million and a half dollars and involve some 70 scientific and supporting personnel in the largest field project ever undertaken by a government service in Canada. This 1961 expedition comprises oceanographers, hydrographers, topographers, geologists, geophysicists, and geographers. They will continue the project's closely integrated study of Canada's polar continental shelf and its northern archipelago and adjacent waters.

Engineering News-Record, April 13, 1961, page 98, contains an interesting item concerning the use of a helicopter by the Portland District of the Corps of Engineers in making soundings in an area where attempts to make soundings from a boat would have been too hazardous.

An extended antenna has been designed for the Tellurometer System to enable surveyors to measure across traffic, over brush, low trees, or other obstacles. Use of a mast up to 40 feet in height permits measurement of lines across highways, low structures, and natural obstacles between two survey stations. Information regarding the new antenna accessory (usable only with the Model MRA/2 system) may be obtained from Tellurometer, Inc., 305 Dupont Circle Building, Washington 6, D. C.

The first Symposium on Oceanography to be held in the Midwest—designed to bring together national leaders in the field to discuss greatly increased training and research programs—was held at the University of Wisconsin, May 15–16, 1961. The symposium was sponsored by the U. S. Office of Naval Research, the National Science Foundation, and the Committee on Institutional Cooperation.

The Trigonometrical Survey Division of the New South Wales Lands Department has measured a line between two first-order triangulation stations which are approximately 102 miles apart. The field work was accomplished in 2½ hours. The discrepancy between the distance as determined with the Tellurometer and as derived from the coordinates of the two stations was 1.7 feet. That is a check of better than 1:300,000. The above information comes from *Cartography,* (Published by the Australian Institute of Cartographers), March 1960, Vol 3, No. 3, page 113.

W. & L. E. Gurley have added the optical-plummet feature to one model in its line of construction transits. Full details on "Gurley Instruments for the Contractor" are available in the 12-page Bulletin 250, obtainable from W. & L. E. Gurley, Troy, N. Y.

Bludworth, Inc., and the name Bludworth Marine, together with all patents, design, trademarks, products and goodwill, have been sold to States Electronics Corporation. The sale included exclusive manufacturing rights to Bludworth Marine products and these will be improved and continue to be available to the marine industry and for surveying operations. States Electronics will also continue to service and supply spare parts for all Bludworth Marine instruments in existing Bludworth Marine service ports. The Corporation is operating in expanded New York quarters at 96 Gold Street with executive offices at 846 Magie Avenue, Elizabeth, New Jersey.

Unitech Corporation has added an engraver to its line of instruments for draftsmen. The engraver, marketed under the name "Aristo," is designed for use on all types of materials and coated surfaces. It has a built-in, wide-angle lens with 4x magnification and is available with a variety of scribing points for single or double lines. Complete information may be obtained from Unitech Corporation, 50 Colfax Avenue, Clifton, N. J.

The 4th International Course in indirect distance measurement is scheduled for September 4–12, 1961, just prior to the German Geodesists' meeting in Munich in 1961. A group of outstanding specialists from Germany and other countries have promised to collaborate. Further details promised but not available for this issue of SURVEYING AND MAPPING.

Benson-Lehner Corporation announced on April 17, 1961, the availability of a new, high-speed, stereo camera capable of photographing even explosive action in three dimensions, with one second of action stretched out to 60 seconds of viewing. The film speed, it is claimed, will accelerate from a standing start to 127 miles per hour in one second.

Survey Post Number One

By D. W. BAIRD, O. L. S.

EDITOR'S NOTE.—About the time we were handling the copy for the article, "Point of Beginning" Commemoration, in the December 1960 issue of SURVEYING AND MAPPING, we received a copy of the July 1960 issue of *The Ontario Land Surveyor,* published by the Association of Ontario Land Surveyors and were quite intrigued by an article therein bearing the title "Survey Post Number One." The article and a picture of the monument it describes are reprinted with permission of ACSM member C. E. Stauffer, Editor of *The Ontario Land Surveyor.*

An ultimate goal of the Land Surveyor is establishing permanent monuments to mark original surveys. We have heard of many different kinds being tried, including radio-active deposits, but with one notable exception the profession has been unsuccessful in coping with the ravages of time, the elements, and bulldozers.

Due to the efforts of Fraser Alysworth, a land surveyor who practiced in Madoc for 40 years until his death in 1939, there was erected in MacDonald Park in the city of Kingston one monument which appears to be permanent.

In 1929, Alysworth recommended to our association that there should be built a monument commemorating the planting of the first survey post in Ontario. After nine years of campaigning, the monument was built.

The first survey post was planted in 1783 by John Collins, then Deputy Surveyor-General, at the southeast corner of Seigniory No. One, now the Township of Kingston.

Mr. Aylsworth in his report to the association in 1931 rather optimistically stated that "this post has not been found yet." Its position can readily be located; and a cursory inspection made today indicated that the chances of finding the post are less likely now than they were in 1931.

It is interesting to note that the first survey line ran from here, set the pattern for many surveys in Ontario in that it was hotly disputed and re-run several times before a boundary was established that suited everyone concerned.

As the position of this original post was not a suitable one for a monument, it was decided to erect it in MacDonald Park on the north side of King St., a short distance west of the original run line.

Subsequent reports on progress toward constructing the monument make interesting reading. Everyone, of course, was in favor of it, but like so many similar projects the difficult question was—who is going to pay for it? With the advance of the depression few in the association felt they could undertake the project. Mr. Aylsworth prevailed on the Historic Sites and Monuments Board to present a suitable plaque, but they would not pay for the monument. Some in our association felt it would suffice to have the plaque mounted on a large boulder, others thought local historical societies might pay for the monument. A monument was finally built of cut limestone, nine and a half feet high and five and a half feet wide at the base. Using this monument, any surveyor can readily tie in a job to the original point from which the whole of the survey system in Ontario was begun.

Thanks to Fraser Aylsworth there is standing a physical reminder of the first survey made in our province—the laying out of Township No. One, and a reminder of the first land surveyor working in Ontario, John Collins, who might well be called Mr. O. L. S. No. One.

Symposium on Geodesy in Space Age

The Institute of Geodesy, Photogrammetry and Cartography in the Division of Geodetic Science of The Ohio State University sponsored a three-day symposium on Geodesy in the Space Age, February 6–8, 1961. More than 200 scientists, engineers, educators, and students from all parts of the United States attended. In addition, there were several scientists from Canada and Europe participating in this symposium.

The program, which is printed below, describes the scope of the symposium and identifies the individuals who participated.

The meetings were held in the Conference Theater of the Ohio Union Building where the facilities for informal conferences before, between, and after the sessions were widely used and added greatly to the over-all success of the symposium.

Monday, February 6, 1961

Opening Session 11 – 12 A. M.
Chairman, Dr. Robert Oetjen, Chairman of the Division of Geodetic Science and Associate Dean of the College of Arts and Sciences, Ohio State University.

Welcoming Address, Dr. Frederic Heimberger, Vice President of Ohio State University.
Greetings from Organizations.
Purpose of the Symposium, Dr. W. A. Heiskanen, Chairman of the Symposium Committee, Director of the Institute of Geodesy, Photogrammetry and Cartography.
Announcements on the Ten Years' Anniversary Exhibits, etc.

Panel of Electronic Methods 2 – 5 P.M.
Moderator, Dr. Simo Laurila, Associate Professor of Geodetic Science, Ohio State University.

Walter N. Dean, Sperry Gyroscope Company—*Loran C.*
Donald Mears, Tellurometer, Inc.—*Hydrodist and Aerodist Systems.*
Captain Carl Aslakson, Geonautics, Inc.—*The Role of Tellurometer in Geodesy.*
Bengt Farnström, AGA Corporation of America—*Geodimeter System and Its Application in Some Foreign Countries.*
Lansing Simmons, U. S. Coast and Geodetic Survey—*Highly Accurate Geodimeter Triangulation in the Cape Canaveral Area.*
Austin Poling, U. S. Coast and Geodetic Survey—*Some Aspects on the Geodimeter Surveying.*
W. St. J. White, Decca Navigator System, Inc. *Application of the Decca Survey in Hydrography.*

Tuesday, February 7, 1961

Panel of Photogrammetric Methods 9 – 12 A. M.
Moderator, Dr. A. J. Brandenberger, Professor of Photogrammetry, Ohio State University.

Dr. Hellmut Schmid, Aberdeen Ballistic Research Laboratories—*Some Problems Connected With the Execution of Photogrammetric Multi-Station Triangulations.*
Albert L. Nowicki, Army Map Service—*AMS Techniques in Aerotriangulation Adjustment.*
G. C. Tewinkel, U. S. Coast and Geodetic Survey—*Analytical Aerotriangulation in the Coast and Geodetic Survey.*
T. J. Blachut, National Research Council, Canada—*Use of the Radar Profile Technique over High Mountains.*
Gilbert Lorenz, ERDL, Fort Belvoir—*Automatic Mapping Developments.*
Dr. H. M. Karara, University of Illinois—*Super Long Triangulated Strips and the Deflection of the Vertical.*

Panel of Physical Geodesy 2 – 5 P. M.
Moderator, Dr. W. A. Heiskanen.

Dr. Urho Uotila, Ohio State University—*Existing Gravity Material.*
Dr. George P. Woollard, University of Wisconsin—*Status of the World Gravimetric System.*
M. Talwani, Columbia University—*Latest Results of Gravity Observations at Sea From Surface Ships.*
Dr. Lloyd Thompson and Bela Szabo, Air Force Cambridge Research Laboratories—*Role of the Airborne Gravity Observations in Determination of the Earth's Gravity Field.*
William P. Durbin, Aeronautical Chart and Information Center—*Some Correlations of Gravity and Geology.*
L. A. Kivioja, Ohio State University—*Some Expected Results Caused by the Melting of Land Supported Ice Caps.*
Hans Baussus, George C. Marshall Space Flight Center—*Some New Aspects Regarding the Estimation of Field Variables in Meteorology and Physical Geodesy.*
Dr. Erik Tengström, Uppsala University, Sweden—*A Comparison Between the Methods of Stokes, Molodensky, and Hirvonen in Physical Geodesy.*
Dr. Walter D. Lambert, U. S. Coast and Geodetic Survey (Retired)—*Significance of the Geoid.*
Dr. W. A. Heiskanen, Ohio State University—*Achievements of the Physical Geodesy.*

Dinner, The Ohio Union Bldg. 7 P. M.

Wednesday, February 8, 1961

Panel of Celestial Methods,
Including the Satellite Geodesy 9 – 12 A. M.
Moderator, Dr. William Markowitz, U. S. Naval Observatory, President of the Section of Geodetic Astronomy of the International Association of Geodesy.

Owen W. Williams, Air Force Cambridge Research Laboratories—*The Role of Rocket Flash Triangulation in World Geodesy.*

Dr. Imre J. Izsak, Smithsonian Institution Astrophysical Observatory—*Ellipticity of the Equator of the Earth.*

William Kaula, National Aeronautical and Space Administration—*The Interaction Between Geodesy and the Space Sciences.*

Dr. Y. Kozai, Smithsonian Institution Astrophysical Observatory—*Potential Field of the Earth Derived From Motions of Artificial Satellites.*

Paul D. Thomas, U. S. Coast and Geodetic Survey—*The Dual Role for Geodesy in the Space Age.*

Frank L. Culley, Army Map Service—*The Use of Secor in Satellites.*

Dr. L. J. Cohen, Naval Weapons Laboratory—*The Transit Satellite and Doppler Techniques.*

Duane Brown, Instrument Corporation of Florida—*On the Potentialities of Geodetic Photogrammetry.*

Dr. William Markowitz, U. S. Naval Observatory—*Accurate Timing of Artificial Satellite Observations on a World-Wide Scale.*

Panel on Education—The Need for and Characteristics of the International Educational Centers of Geodetic Science. 2–5 P.M.

Moderator, Charles A. Whitten, U. S. Coast and Geodetic Survey, President of the International Association of Geodesy.

Charles A. Whitten—*Introduction.*

Dr. J. Osborn Fuller, Ohio State University—*The Scope of the Geodetic Science in a University.*

Dr. Ivan Mueller, Ohio State University—*Geodetic Science Education in Some Other Countries.*

Dr. A. J. Brandenberger, Ohio State University—*Geodetic Science From the Point of View of Training of Foreign Students.*

Dr. W. A. Heiskanen, Ohio State University—*Educational Centers of Geodetic Science From the National Point of View.*

EXHIBITS

Ten Years' Anniversary Exhibits of the Institute of Geodesy, Photogrammetry and Cartography were on display in Rooms 6 and 9, Denney Hall, 164 West 17th Avenue, Columbus, Ohio, during the symposium.

Whitten Resigns

Charles A. Whitten, Chairman, Publications Committee, ACSM, has submitted his resignation. Like all good men who can get things done, he has had many extracurricular activities added to his normal duties with the Coast and Geodetic Survey. The "straw that broke the camel's back" apparently was his election to the presidency of the International Association of Geodesy, a task which will be sure to "keep him out of mischief" for the next four years at least.

During the more than five years that Mr. Whitten and your editor have been closely associated in the production of SURVEYING AND MAPPING, things have gone as smoothly as anyone has a right to expect in this sort of work, and to fill the vacancy he will leave will not be an easy matter. Associate Editor A. J. Wraight will take over as chairman of the Publications Committee. This should put us both in a position to defer when necessary to the good judgement of the retiring chairman, and this should serve to smooth out some of the bumps incident to any such change of authority.

Thank you, Mr. Whitten, for all you have done in the past, and here's hoping you will continue to help us out now and then in a pinch.

—EDITOR

Dr. Heckmann Received Watson Medal

At its annual meeting, April 24, 1961, the National Academy of Sciences awarded its James Craig Watson Medal to Otto Hermann Leopold Heckmann in recognition of his noteworthy contributions to astronomy.

A professor of astronomy at the University of Hamburg and director of the Hamburg Observatory at Bergedorf, West Germany's leading observatory, Dr. Heckmann is widely known for his astrometric work. Under the direction of his predecessor, R. Schorr, the Hamburg Observatory undertook around 1930 the enormous task of photographing and measuring the positions of the stars of the Northern hemisphere. This work, known as the AGK2, was published in fifteen volumes.

Dr. Heckmann initiated a repetition of it, enlisting the cooperation of a group of observatories in Canada, England, France, West Germany, East Germany, USSR, and the United States Naval Observatory in Washington to join in a concerted effort to derive, by new observations, the proper motions of 180,000 stars. Completion of the new catalogue, AGK3, is expected in about three years.

Oceanographic Survey in the North Pacific

An entirely new approach to deep sea oceanography is being tested this year by the Coast and Geodetic Survey Ship *Pioneer*.

Early in April the 311-foot *Pioneer* began a systematic study of three million square miles of ocean between the Hawaiian Islands and the Aleutian Islands. This is the first serious attempt by the government to study wide ocean areas with systematic, closely-spaced observations encompassing nearly all aspects of oceanography.

The President recently asked Congress for additional funds to spend on a national oceanography program, in order that more comprehensive surveys, such as this one, may be undertaken. The Coast and Geodetic Survey will provide the necessary leadership to implement the Department of Commerce phase of the oceanographic program. This pilot project will be followed by more comprehensive programs as facilities and personnel are expanded to meet developing requirements.

Operating out of Alaska and Hawaii, the *Pioneer* will navigate along a series of north-south lines spaced 10 miles apart across an area about 300 miles wide and 2,000 miles long. The first line was planned to follow a course 10 miles east of the 158th meridian, commencing at a point just south of the Alaska peninsula and extending southward to the Island of Oahu, Hawaii. Subsequent lines are to move eastward during the 1961 season.

The project ultimately will extend from the Hawaiian Archipeligo to the Aleutian Islands and from the 153rd meridian westward to the 180th meridian. Ocean surveys of this magnitude have never been attempted before. In the past, oceanographic expeditions have been limited to relatively isolated reconnaissance lines or have concentrated on one particular phase of oceanography related to a specific research problem.

A systematic survey of the oceans is possible today with the development of modern techniques, equipment, and data processing. The *Pioneer* will be fitted with Loran C positioning equipment for control purposes. Anticipated range of this system is 1,500 nautical miles for ground waves and 3,000 nautical miles for sky waves. Accuracy of position is reported to be 1,000 feet at 1,000 miles using ground waves. Loran C Stations in the Hawaiian Islands are not yet operational. Work during the first part of the season will be limited to that area effectively covered by the Aleutian Loran C control system.

The first phase of the survey will include a continuous profile of the ocean bottom obtained with a precision depth recorder, a continuous profile of the total magnetic field made by a towed Varion Proton Magnetometer, regular gravity observations by a La Coste-Romberg gravity meter, regular meteorological balloon releases, and a sea water temperature observation every two hours. Aboard the *Pioneer* during this phase will be geophysicists from the U. S. Geological Survey and the Coast and Geodetic Survey, a meteorologist from the U. S. Weather Bureau, oceanographers from the Coast and Geodetic Survey, and, if present plans materialize, student oceanographers from one or more universities. This is in addition to the 90-man crew of the *Pioneer,* including 21 commissioned officers of the Coast and Geodetic Survey. The vessel is commanded by Captain William F. Deane.

Additional observations at predetermined locations will be made during the second phase beginning in September. At these locations bottle casts will be made for temperature, salinity, dissolved oxygen, and such other variables as the cooperating agencies may wish to measure. Sediment cores will be made at each station, and the U. S. Geological Survey will process the sediment data. Plankton tows are planned with the U. S. Bureau of Commercial Fisheries supplying biologists and equipment. Current measurements are planned in the Alaska Boundary Current. These oceanographic observations will be spaced along a course north from the Hawaiian Islands to the Aleutian Trench, west along the axis of the trench to turn south in the area of Adak, and proceeding past Midway Island to 23 degrees 30 minutes north, thence east to Hawaii.

The Committee on Oceanography of the U. S. National Academy of Sciences–National Research Council proposed this survey approach to oceanography in Chapter 9 of its report, Oceanography 1960–1970. This report recommends an ocean-wide survey with all maritime nations cooperating. If the job is ever to be completed, it must obviously be an international effort of formidable proportions. The Coast and Geodetic Survey in the *Pioneer* surveys is undertaking a trial run to see how much one ship can accomplish, to see what observations should be undertaken, and to see if the results justify the effort.

ACSM Action on NCSBEE "A Model Law"*

BACKGROUND

The American Congress on Surveying and Mapping in 1946 adopted the Technical Standards for Property Surveys, in which was included: The Congress recommends and urges its members to consummate in every State the enactment of satisfactory legislation to provide for: 1. Licensing of Land Surveyors and making provision for: (a) survey of boundaries of land holdings and the accurate measurement of any and all cadastral and topographic features, including the establishment of grades and alignments for highways and for public and private utilities: . . . (*See* Standards for entire recommendation.)

The Model Registration Law Committee of the Property Surveys Division (ACSM) presented a proposal to the Division Annual Meeting in March 1958 and such proposal was, by sanction of ACSM, distributed to local surveyor organizations and State Examining Boards for their information and comment.

The National Council of State Boards of Engineering Examiners appointed a committee in 1959 to study and propose a model law for surveying registration, and, in March 1960, this committee met and discussed the matter with such members of the ACSM attending the Annual Meeting who desired to express views and reasons on the subject.

The Surveying Committee of the NCSBEE presented a Model Law for the Registration of Land Surveyors to the NCSBEE in August 1960, which was adopted by that body.

The Legislative Committee of the Property Surveys Division and the Executive Committee of the same group have made a study of the aforementioned proposal and find that, with the exception of a section permitting corporate practice, the NCSBEE Model Law embodies all of the principles set forth by the 1946 recommendations adopted by the ACSM, the principles set forth in the 1958 Property Surveys Division proposal, and the principles expressed by the vast majority of surveying professionals in the country (especially in regard to qualifications of applicants, scope of examination, and scope of practice) in regard to registration of Land Surveyors.

ACSM-PSD RESOLUTION

The Property Surveys Division of the American Congress on Surveying and Mapping does hereby endorse, with the exception of the corporate practice section, the MODEL LAW CHAPTER 2 adopted by the National Council of State Boards of Engineering Examiners in August 1960 as being at the present time a reasonable and satisfactory guide for the preparation of uniform laws for the registration of Land Surveyors.

ACSM Property Surveys Division
Land Surveyors Annual National Conference
Washington, D. C., March 23, 1961

FURTHER ACTIONS

ACSM Board of Direction approved the above action of its Property Surveys Division and gave the Division permission to so notify NCSBEE of its action.

ACSM Board of Direction also endorsed, with the exception of the corporate practice section, as modified by ACSM Property Surveys Division, The MODEL LAW CHAPTER 2 adopted by the NCSBEE in 1960 as being for the present time a reasonable and satisfactory guide for the preparation of uniform laws for the registration of Land Surveyors, and will notify the NCSBEE of its action.

From ACSM Board of Direction Meeting,
Washington, D. C., March 25, 1961
WALTER S. DIX, *Executive Secretary*, ACSM

* National Council of State Boards of Engineering Examiners. A MODEL LAW. A Guide for the Preparation of Uniform Laws for the Registration of Engineers and Land Surveyors. Adopted 18 August 1960 at the Annual Meeting of NCSBEE in Portland, Oregon.

IT IS NOT TOO EARLY TO BEGIN PLANNING
TO ATTEND THE 1962 MEETINGS
SHOREHAM HOTEL, WASHINGTON, D. C., MARCH 11–17, 1962

Recommended Reading

"Surveying Is Engineering," an editorial in *Engineering News-Record,* April 27, 1961, Vol. 166, No. 17, page 102.

"Why Negotiate for Photogrammetric Services?" by A. O. Quinn, *Civil Engineering,* November 1960, page 64.

"Why Adopt the Metric System" by Floyd W. Hough, *Civil Engineering,* November 1960, pages 73–75.

"Slope Distances by Slide Rule" by Burton G. Dwyer, *Civil Engineering,* November 1960, page 76.

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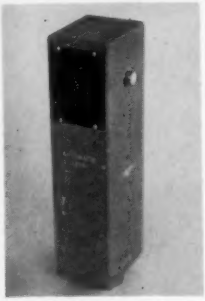

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I can tell you honestly that except for a miracle that happened I could not enclose this check. The wolf that comes to many doors nowadays just had pups in my kitchen. I sold them and here is the money.

Reprinted from *Title News,* Vol. XXXVII, No. 12, December 1958.

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